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**CLIFF COMMUNITY BIRD AND MAMMAL POPULATIONS
IN THE BOULDER MOUNTAIN PARK**

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INTRODUCTION

The steep sedimentary rocks on the eastern slopes of Green Mountain, Bear Peak, and South Boulder Peak, known locally as "The Flatirons," support a remarkable diversity of wildlife. Fifteen raptor species, including golden eagles, peregrine falcons, prairie falcons, northern goshawks and flammulated owls, have nested on the cliffs or in adjacent drainages. Wild fruits growing in these canyons attract foraging black bears in late summer and early fall. Mountain lions, red foxes, gray foxes, and coyotes also frequent these canyons and the nearby mesas.

Because the Flatirons are an extremely popular destination for climbers and hikers, there is potential for conflict between recreational users and wildlife. Beginning in the late 1980s, Mountain Parks staff instituted seasonal closures of climbing routes and some canyons to protect cliff-nesting raptors. Trails have been reconstructed and rerouted to stabilize eroded areas and prevent damage to sensitive plant communities. Plant studies, breeding bird studies, and an ongoing raptor nest monitoring program have provided information to help staff manage recreation within the Park. Nevertheless, a thorough inventory of wildlife resources in the Flatirons has never been undertaken. Little is known about denning locations of black bears, mountain lions, and other mammals; nesting locations of accipiters and small owls; and songbird population densities.

At the request of the City of Boulder Mountain Parks Department, I carried out a two season census of wildlife populations along ten 500 m transects located in Flatirons canyons between Gregory Canyon and Bear Canyon (Figure 1). I also conducted a search throughout the

canyons and cliffs for nesting raptors and nesting songbirds of special concern (county listed, state listed, and federal listed species). I supplemented my own observations with data from ongoing studies, including the raptor nest monitoring program, the Boulder County Nature Association small owl study, and the Mountain Parks predator sighting database. The ultimate goal of this report is to provide baseline data and maps which will help Mountain Parks staff to protect sensitive wildlife areas and to better manage recreational activities.

STUDY AREA

The Boulder Mountain Park is a 24 km² area of forested mountains to the west of Boulder, extending south to north from Eldorado Springs to Sunshine Canyon (Figure 1). Elevations within the Park range from 1,640 m (5,400') to 2,590 m (8,549'). The most conspicuous physiographic feature within the Park is "The Flatirons," triangular shaped remains of hogback ridges steeply tilted against the flanks of Green Mountain, Bear Peak, and South Boulder Peak. The summits of these peaks rise approximately 900 m (3,000') above the plains. Steep canyons cut through the east slope of these mountains. Topography on the west side of these peaks is less severe, with long, relatively gently sloping ridges, table lands, and canyons. Several small streams flow from west to east through the Park.

Cooper (1984) described eight general categories of vegetation within the Mountain Park: ponderosa pine forest, Douglas-fir forest, mixed ponderosa/Douglas-fir forest, grassland-forest ecotone, mountain riparian, foothills riparian, grassland, rock faces and rock canyons. Coniferous forest is the dominant vegetation type throughout the Park (Jones 1990). The composition of this forest varies considerably (Colorado State Forest Service 1982, Jones 1990). Douglas-fir forest generally occurs on north-facing and east-facing slopes. South-facing slopes and ridges usually support more open stands of ponderosa pine.

The disturbance history of the Mountain Park forest is not well known. Much of the coniferous forest along the Front Range was cut or burned by miners and other settlers during the

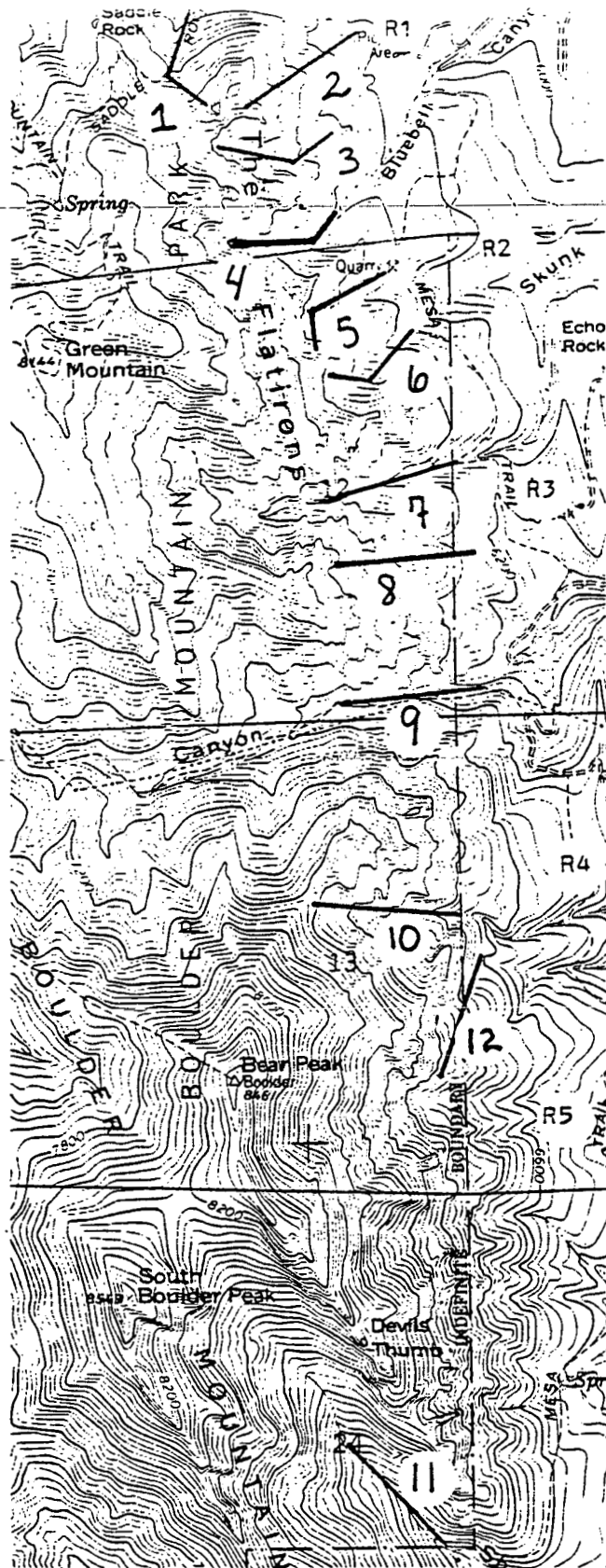


Figure 1. Study Area and Transect Locations.

- | | | |
|------------------------|------------------|-------------------|
| 1. First Flatiron | 5. Tangen Spring | 9. Bear Canyon |
| 2. First/Sec. Flatiron | 6. Royal Arch | 10. Fern Canyon |
| 3. Sec./Third Flatiron | 7. Skunk Canyon | 11. Shadow Canyon |
| 4. Bluebell Canyon | 8. Dinosaur Mt. | 12. The Slab |

R1-R5: raptor reconnaissance points

latter half of the nineteenth century (Smith 1981, Goldblum 1990, Veblen and Lorenz 1991).

Although some larger trees are found throughout the Mountain Park, the area is mostly forested by second growth stands with most canopy trees in the 75 - 150 year age class (Colorado State Forest Service 1982).

The small streams that cut through the Flatirons support a mountain riparian community of smaller deciduous trees and shrubs, including cottonwoods (Populus spp.), willows (Salix spp.), aspen (Populus tremuloides), river birch (Betula fontinalis), box elder (Negundo aceroides), Rocky Mountain maple (Acer glabrum), hazelnut (Corylus cornuta), wild plum (Prunus americana), and chokecherry (Padus virginiana). These mountain riparian communities support a number of uncommon or regionally disjunct breeding bird species, including flammulated owl, MacGillivray's warbler, ovenbird, and chestnut-sided warbler (Jones 1990). Dense stands of Douglas fir growing in the shady canyons support Cooper's hawks, sharp-shinned hawks, northern goshawks, hermit thrushes, western flycatchers, and other "forest interior" species.

The adjacent Flatirons cliffs support a dozen species of cliff-nesting birds. More than half of the known prairie falcon and peregrine falcon eyries in the county lie within the Flatirons between Gregory Canyon to the north and Eldorado Mountain to the south (Armstead and Lederer 1995). A pair of golden eagles has nested in the Flatirons, in Skunk Canyon, since at least 1983 (Armstead and Lederer 1995). Turkey vultures nested west of the Third Flatiron in 1992 and 1993 (Steve Armstead pers. commun.). This was only the second turkey vulture nest ever reported in Boulder County (Dave Hallock pers. commun.). Red-tailed hawks, American kestrels, rock doves, common ravens, white-throated swifts, violet-green swallows, canyon wrens, and rock wrens also nest on the Flatiron cliffs.

The Flatirons area of the Boulder Mountain Park, lying roughly west of the Mesa Trail and east of the summits of Green Mountain and Bear Peak, receives heavy recreational use. The First, Second, and Third Flatirons are particularly popular with rock climbers, and all of the Flatirons canyons contain climber's trails or social trails. In many of the canyons, these trails have caused significant erosion. Staff has instituted seasonal closures of some canyons and cliffs to protect nesting raptors. Interactions between humans and large mammals, including mountain lions and black bears, frequently occur in the lower canyons, from the Mesa Trail eastward (Boulder Mountain Park predator sighting database 1995).

METHODS

I conducted wildlife surveys along ten 500 m transects located in the major Flatirons drainages between Gregory Canyon and Bear Canyon (Figure 1). Transects were first mapped on a 7-1/2' topographic map and then ground truthed. After I had walked each transect one time, I adjusted the starting and ending points to coincide as closely as possible with trail junctions and other prominent landmarks. While walking the transects, I followed existing trails whenever possible.

Between 25 May - 10 July I conducted two accipiter surveys on each transect. Accipiter surveys were conducted between 7:00 a.m. and 9:00 a.m. M.S.T. I walked slowly along the transect line, stopping every 150 m to play accipiter territorial calls on a Soundesign Model 46358LK portable tape recorder. During the first survey I played only the Cooper's hawk and sharp-shinned hawk territorial calls (15 seconds on and 25 seconds off, 3 replications). During the second survey I played the Cooper's hawk, sharp-shinned hawk, and northern goshawk territorial calls following the same procedure.

Between 25 May and 10 July I conducted two breeding bird surveys along each transect. Breeding bird surveys were conducted between 5:00 a.m. and 7:00 a.m. M.S.T. I walked slowly along the transect line, stopping every 25 m to look and listen for breeding birds. I counted all birds seen or heard within 50 m of the transect line. Thus, the dimensions of the areas surveyed were 500 m by 100 m, or approximately 5 ha. After walking each transect, I spent an additional hour searching for breeding birds in the upper portions of each drainage. By combining the

results of these surveys with the results of previous studies in the Mountain Park, I was able to compile relatively comprehensive breeding bird lists for each drainage.

I revisited each drainage once more between 20 August and 5 November to look for mammals, mammal tracks, and mammal sign. I recorded all mammals detected on these surveys and on previous surveys as "present" within each drainage. I supplemented these observations with information from the Boulder Mountain Park predator database and with results of surveys conducted along two additional transects (Fern Canyon and Shadow Canyon) in 1989.

Between 15 April and 25 May I spent 15 hours searching for accipiters and cliff-nesting raptors from 5 reconnaissance points (5 hours at each point), each located approximately 1 km east of the Flatirons (Figure 1). I supplemented these observations with data from the Boulder Mountain Park cliff-nesting raptor monitoring program to map nesting and roosting locations of accipiters and cliff-nesting raptors.

RESULTS AND DISCUSSION

Breeding Bird Populations

I observed a total of 66 potential breeding bird species within the study area during the 1989, 1990, 1995, and 1996 breeding seasons (Table 1). This breeding bird list can be broken down into five subgroups: birds that typically nest in coniferous forests (33 species), birds of mountain riparian communities (6 species), birds of foothills shrub communities (2 species), cliff-nesting birds (10 species), and habitat generalists (15 species). Most abundant species, in order of abundance, were: white-throated swift, violet-green swallow, western flycatcher, American robin, Steller's jay and yellow-rumped warbler (Table 2).

A total of 4 species occurred in all 13 drainages sampled: turkey vulture, white-throated swift, violet-green swallow, and mountain chickadee (Table 1). Shrub-nesters and mountain riparian community nesters tended to nest in more scattered populations. For example, lazuli buntings occurred in only four drainages, Virginia's warblers occurred in seven drainages, and MacGillivray's warblers occurred in eight drainages.

The relatively patchy distribution of shrub-nesting and mountain riparian nesting species reflects topographical and vegetational differences among the 13 drainages. Some, such as Bear Canyon and Bluebell Canyon, contain well developed riparian communities of cottonwood (*Populus* spp.), willow (*Salix* spp.), box elder (*Negundo aceroides*), Rocky Mountain maple (*Acer glabrum*), and other deciduous trees and shrubs. Others, such as the drainage between the First and Second Flatirons and the drainage south of Royal Arch, contain little or no deciduous

Table 1. Breeding Bird Species Observed in Study Areas.¹

- | | | |
|---------------------|----------------------|-------------------|
| 1. 1st Flatiron | 5. Tangen Spring | 9. Bear Canyon |
| 2. 1st/2nd Flatiron | 6. Royal Arch | 10. Fern Canyon |
| 3. 2nd/3rd Flatiron | 7. Skunk Canyon | 11. Shadow Canyon |
| 4. Bluebell Canyon | 8. Dinosaur Mountain | |

Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
Mallard								X			
Turkey Vulture	X	X	X	X	X	X	X	X	X	X	X
Sharp-shinned Hawk										X	
Cooper's Hawk					X	X					
Northern Goshawk					X						X
Red-tailed Hawk											X
Golden Eagle							X	X	X		X
American Kestrel		X								X	X
Peregrine Falcon		X	X	X							X
Prairie Falcon				X			X	X	X	X	X
Blue Grouse						X			X	X	X
Rock Dove	X			X					X	X	X
Mourning Dove		X	X				X				X
Flammulated Owl			X	X	X		X		X		X
Great Horned Owl									X		X

<u>Species</u>	<u>#1</u>	<u>#2</u>	<u>#3</u>	<u>#4</u>	<u>#5</u>	<u>#6</u>	<u>#7</u>	<u>#8</u>	<u>#9</u>	<u>#10</u>	<u>#11</u>
Common Raven	X	X	X	X	X	X	X		X	X	X
Mountain Chickadee	X	X	X	X	X	X	X	X	X	X	X
Red-breasted Nuthatch			X	X		X			X		X
White-breasted Nuthatch		X				X	X	X	X		X
Pygmy Nuthatch			X	X		X			X		
Brown Creeper						X					
Rock Wren		X	X	X	X			X			
Canyon Wren	X			X	X	X	X	X	X	X	X
Northern House Wren	X				X		X	X	X	X	X
American Dipper			X	X					X		
Townsend's Solitaire	X	X					X	X	X	X	X
Hermit Thrush	X		X	X		X	X		X	X	X
American Robin	X	X		X	X		X	X	X	X	X
Solitary Vireo		X	X	X	X	X		X	X		
Warbling Vireo			X	X	X	X	X	X	X		X
Virginia's Warbler	X				X		X	X	X	X	X
Yellow Warbler			X	X		X			X		
Yellow-rumped Warbler	X	X		X	X	X	X	X	X	X	X
MacGillivray's Warbler		X	X	X	X	X		X	X		X

Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
Western Tanager		X	X	X	X	X	X	X	X		X
Black-headed Grosbeak	X	X			X		X	X	X		X
Lazuli Bunting							X	X	X		X
Green-tailed Towhee				X		X	X	X	X		
Rufous-sided Towhee			X	X	X	X	X	X	X		X
Chipping Sparrow	X		X	X	X	X	X		X	X	X
Gray-headed Junco	X	X		X	X	X		X	X	X	X
Brown-headed Cowbird							X	X	X		
Cassin's Finch									X		
Red Crossbill		X	X	X		X					
Pine Siskin	X	X		X	X	X	X	X		X	X
Lesser Goldfinch					X			X	X		X
American Goldfinch									X		
Total	19	26	27	35	29	33	33	37	50	26	42

¹Includes sightings from 1989, 1990, and 1995 breeding seasons, 1983-95 cliff-nesting raptor study (Armstrong and Lederer 1995) and 1986-91 small owl study (Jones 1991).

Table 2. Plot Densities of Breeding Birds.
Mean Number per Count.

- | | | |
|---------------------|----------------------|--------------------|
| 1. 1st Flatiron | 5. Tangen Spring | 9. Bear Canyon |
| 2. 1st/2nd Flatiron | 6. Royal Arch | 10. Fern Canyon |
| 3. 2nd/3rd Flatiron | 7. Skunk Canyon | 11. Shadown Canyon |
| 4. Bluebell Canyon | 8. Dinosaur Mountain | |

Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
Mallard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Golden Eagle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prairie Falcon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Rock Dove	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.5
White-throated Swift	1.0	2.5	7.5	5.0	0.0	0.5	0.5	2.0	0.5	0.0	0.0
Broad-tailed Hummingbird	0.5	0.5	0.5	0.0	0.0	0.5	0.5	2.0	0.5	0.0	0.0
Hairy Woodpecker	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	1.0	1.0
Northern Flicker	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.5	0.0	1.0	1.0
Western Wood-Pewee	0.0	1.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Woodward's Flycatcher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Western Flycatcher	0.0	0.5	2.0	3.0	0.0	0.5	4.0	2.0	2.0	2.0	2.0
Western Kingbird	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Violet-green Swallow	0.0	1.5	5.0	10.0	2.5	0.5	0.0	1.5	5.0	0.5	0.0
Steller's Jay	1.0	0.0	0.0	2.5	1.5	0.5	1.0	0.0	1.5	3.0	1.0
Common Raven	1.0	0.5	1.0	0.5	0.5	0.5	0.0	0.0	0.0	1.0	1.0

<u>Species</u>	<u>#1</u>	<u>#2</u>	<u>#3</u>	<u>#4</u>	<u>#5</u>	<u>#6</u>	<u>#7</u>	<u>#8</u>	<u>#9</u>	<u>#10</u>	<u>#11</u>
Mountain Chickadee	0.5	0.5	1.0	1.0	1.5	1.5	0.0	0.0	1.0	3.0	1.0
Red-breasted Nuthatch	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.5	0.0	0.0	0.0
White-breasted Nuthatch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Pygmy Nuthatch	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.5
Brown Creeper	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Rock Wren	0.0	0.5	0.0	0.0	1.0	1.0	0.0	0.5	0.0	0.0	0.0
Canyon Wren	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.5	0.5	0.0
Northern House Wren	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Townsend's Solitaire	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Hermit Thrush	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American Robin	0.5	1.0	0.5	1.0	0.5	1.5	1.5	0.5	1.0	1.0	5.0
Solitary Vireo	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Warbling Vireo	0.0	0.0	0.0	0.5	0.0	0.5	2.5	0.5	0.0	0.0	0.5
Virginia's Warbler	0.0	0.0	0.5	0.5	1.0	2.0	0.5	0.5	1.0	2.0	0.5
Yellow-rumped Warbler	0.0	1.5	1.5	2.0	0.5	0.0	0.0	1.0	0.0	3.0	2.5
MacGillivray's Warbler	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	1.0	0.0	2.0
Western Tanager	0.0	0.0	0.5	0.0	1.0	1.0	1.5	1.5	0.5	0.0	2.0
Black-headed Grosbeak	0.5	0.0	0.5	0.0	1.0	0.5	0.0	1.0	1.0	0.0	0.0
Lazuli Bunting	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.5

<u>Species</u>	<u>#1</u>	<u>#2</u>	<u>#3</u>	<u>#4</u>	<u>#5</u>	<u>#6</u>	<u>#7</u>	<u>#8</u>	<u>#9</u>	<u>#10</u>	<u>#11</u>
Green-tailed Towhee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Rufous-sided Towhee	0.0	0.0	0.0	0.5	0.0	1.5	1.0	0.0	0.5	0.0	0.0
Chipping Sparrow	0.0	0.0	1.0	0.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Gray-headed Junco	0.5	0.5	1.0	0.5	0.0	1.0	0.0	1.5	0.0	1.0	1.0
Brown-headed Cowbird	0.0	0.0	0.0	1.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0
Pine Siskin	2.5	0.5	0.0	0.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0
Lesser Goldfinch	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.5	0.0
Total	10.0	15.5	26.0	32.0	15.0	16.0	15.5	21.5	17.5	24.0	25.5

ADDENDA TO TABLES 1 and 2. 1996 Breeding Bird Sightings in The Slab area of Bear Peak

Breeding Bird Plot (Mean No. Per Count): Prairie Falcon 1.0, White-throated Swift 2.0, Northern Flicker 0.5, Western Wood-Pewee 0.5, Cordilleran Flycatcher 2.0, Violet-green Swallow 1.5, Steller's Jay 1.0, Mountain Chickadee 0.5, Red-breasted Nuthatch 1.0, Northern House Wren 0.5, Townsend's Solitaire 1.0, American Robin 1.5, Virginia's Warbler 1.0, Yellow-rumped Warbler 2.0, MacGillivray's Warbler 3.0, Western Tanager 1.0, Chipping Sparrow 0.5, Pine Siskin 2.0.

Breeding Bird Species Observed: White Pelican, Turkey Vulture, Sharp-shinned Hawk, Prairie Falcon, Mourning Dove, White-throated Swift, Broad-tailed Hummingbird, Hairy Woodpecker, Northern Flicker, Western Wood-Pewee, Cordilleran Flycatcher, Violet-green Swallow, Steller's Jay, Mountain Chickadee, Red-breasted Nuthatch, Northern House Wren, Townsend's Solitaire, American Robin, Warbling Vireo, Virginia's Warbler, Yellow-rumped Warbler, MacGillivray's Warbler, Western Tanager, Chipping Sparrow, Dark-eyed Junco, Pine Siskin.

vegetation. All 13 drainages contain cliffs, but some cliffs appear more suitable than others for nesting. Prairie falcons, canyon wrens, and rock wrens appear to prefer south-facing cliffs containing cracks and potholes. White-throated swifts and violet-green swallows nest colonially and appear to prefer steep cliffs with numerous interconnected cracks and ledges.

Table 3 summarizes breeding bird densities within the 13 drainages. Shadow Canyon, Fern Canyon, and Bluebell Canyon, which contain steep, south-facing cliffs and well developed riparian communities, all support relatively high densities of nesting birds. These drainages also support several species of special concern, including prairie falcon and flammulated owl (Table 4).

Cliff-nesting Raptors

The status of cliff-nesting raptors in the Boulder Mountain Park has been summarized by Armstead and Lederer (1995). Prior to the 1995 nesting season, they had documented three peregrine falcon nesting sites and four prairie falcon nesting sites within the Park (See Figures 2 and 3). During the 1995 breeding season, I discovered a fifth prairie falcon nesting site on Dinosaur Mountain (Figure 3). Both peregrine sites were active in 1995, and both nests failed. The Dinosaur Mountain and Fern Canyon prairie falcon sites were active in 1995. The Dinosaur Mountain nest failed, and the Fern Canyon nest fledged at least three young (Armstead and Lederer, 1995).

Table 3. Characteristics of Breeding Bird Populations.

<u>Plot Name</u>	<u>Mean Species</u>	<u>Mean Individuals</u>	<u>% Cliff Nesters</u>	<u>% Cavity Nesters</u>
1st Flatiron	6.0	10.0	18	15
1st/2nd Flatiron	11.5	15.5	29	16
2nd/3rd Flatiron	13.5	26.0	51	11
Bluebell Canyon	12.0	32.0	50	6
Tangen Springs	12.0	17.0	29	14
Royal Arch	13.0	16.0	9	25
Skunk Canyon	8.5	15.5	6	0
Dinosaur Mountain	12.0	20.5	14	12
Bear Canyon	10.0	17.0	41	5
Fern Canyon	11.5	24.0	27	17
Shadow Canyon	13.5	25.5	18	10
Bear Peak Slab	11.5	22.5	20	18

Table 4. Occurrence of Boulder County Breeding Bird Species of Special Concern in Selected Mountain Park Canyons.¹

X--Indicates species believed nesting during at least one year from 1989-95.

<u>Species</u>	<u>Shadow Canyon</u>	<u>Bear Canyon</u>	<u>Skunk Canyon</u>	<u>Bluebell Canyon</u>	<u>Long Canyon</u>	<u>Lost Gulch</u>
Northern Goshawk						X
Golden Eagle			X			
Prairie Falcon	X	X		X		
Peregrine Falcon	X			X		
Flammulated Owl	X	X	X	X	X	X
Chestnut-sided Warbler					X	
Ovenbird					X	
Yellow Warbler		X			X	

¹See Boulder County Parks and Open Space. 1994. Boulder County Avian Species of Special Concern list. Also see Jones. 1989. Boulder Mountain Park Forest Bird Study.

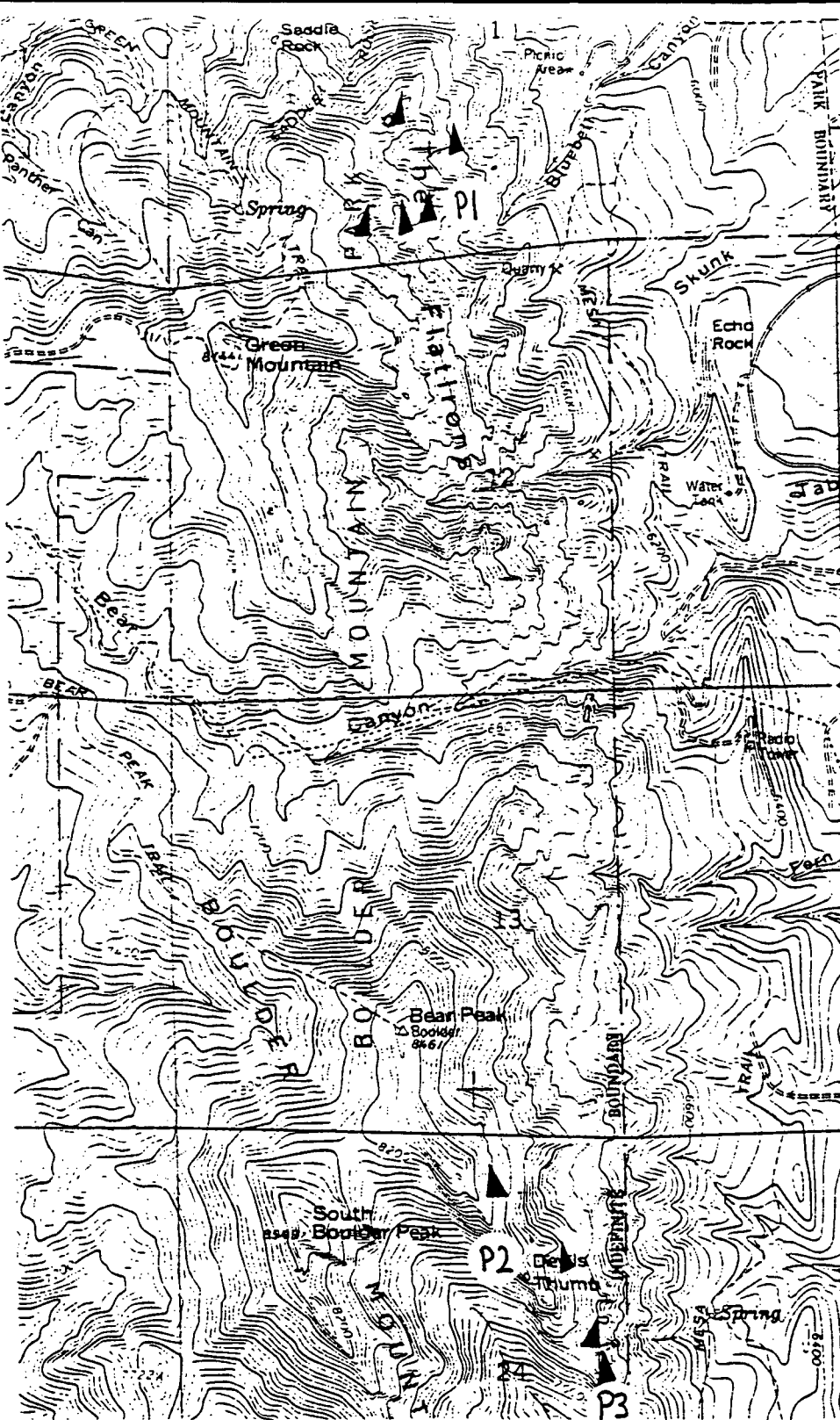


Figure 2: Peregrine Falcon Historic Nest Locations and Perches.

- P1: 1994-96
- P2: 1991
- P3: 1992-96

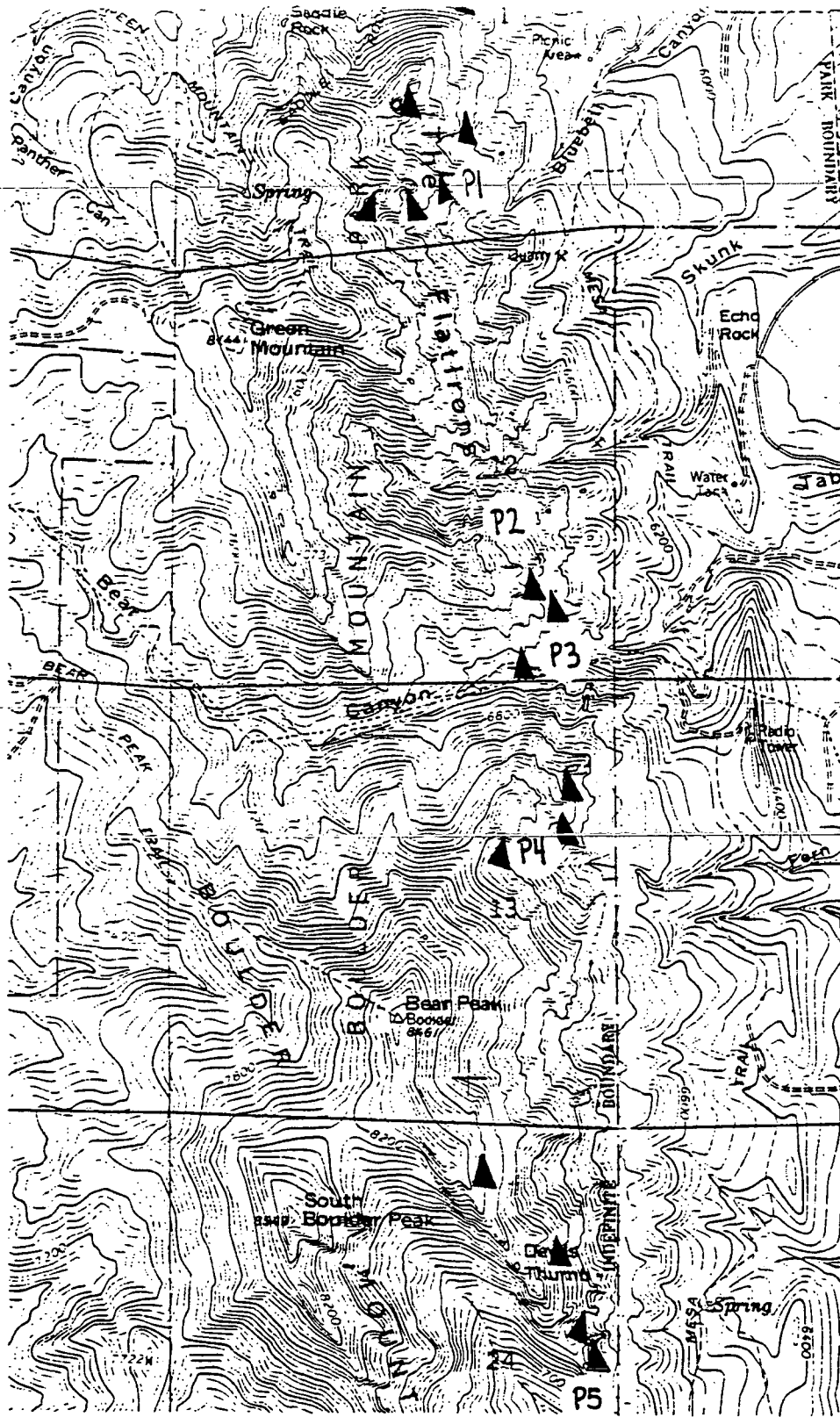


Figure 3 Prairie Falcon Nest Locations and Perches.

P1: 1983-93
 P2: 1995-96
 P3: 1984-88

P4: 1983-96
 P5: 1983-93

During the 1996 breeding season, a peregrine falcon nest on the Third Flatiron failed, and a second nest on the Matron in Shadow Canyon fledged two young. The Dinosaur Mountain prairie falcon site and an historic prairie falcon site on Jam Crack Spire were active, but no nesting activity was observed (Steve Armstead, pers. commun.).

Golden eagles have nested in Skunk Canyon, on South Boulder Peak, and on Bear Peak (Figure 4). The Skunk Canyon sites have been active continuously since 1983. A pair of eagles occupied this site in 1995, but they did not construct a nest (pers. obs., Armstead and Lederer 1995). This site fledged one young in 1996 (Steve Armstead, pers. commun.). The South Boulder Peak site was last active in 1984. The Bear Peak site was last known to be active prior to 1943 (Jollie 1943, Armstead and Lederer 1995).

Turkey vultures nested between the First and Second Ironing Boards, west of the Third Flatiron, in 1992-3 (Steve Armstead, pers. commun. -- Figure 5). This was only the second documented nesting of turkey vultures in Boulder County (Dave Hallock, Boulder County Parks, pers. commun.). No nesting activity was reported at this site in 1994-5. I observed five turkey vultures soaring over the Flatirons throughout the 1995 and 1996 breeding seasons, but I was unable to locate a nest.

Great horned owls have nested in a pothole in the Amphitheater, on the south side of Gregory Canyon (Figure 6) and may nest on cliffs in other regions of the Mountain Park. Red-tailed hawks have nested on cliffs in the Shadow Canyon region. American kestrels frequently nest on cliffs in eastern Colorado, but no cliff nests have been observed within the Mountain Park.

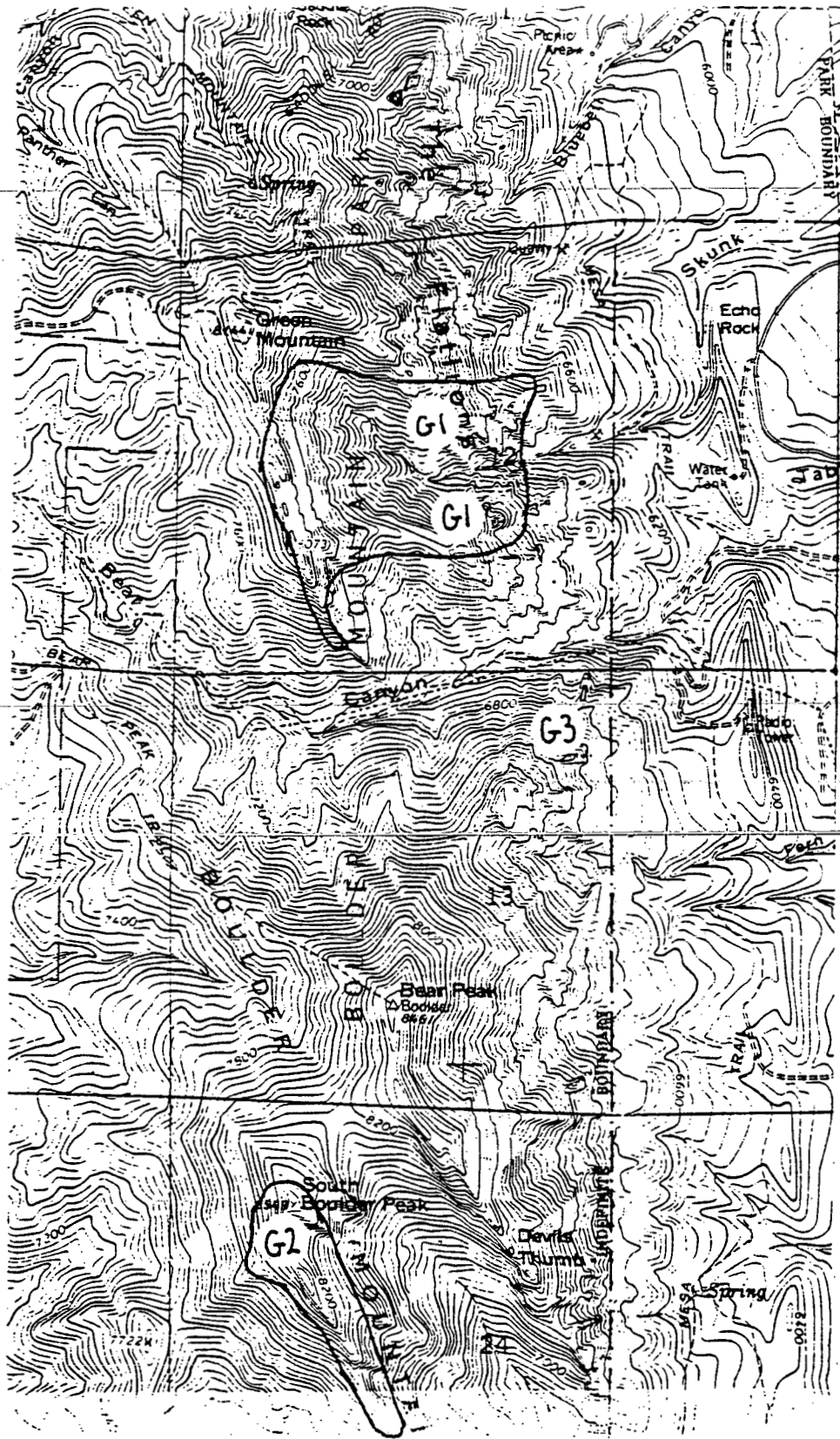


Figure 4. Golden Eagle Nests and Perch Locations.

G1: 1983-96

G2: 1984

G3: Before 1943

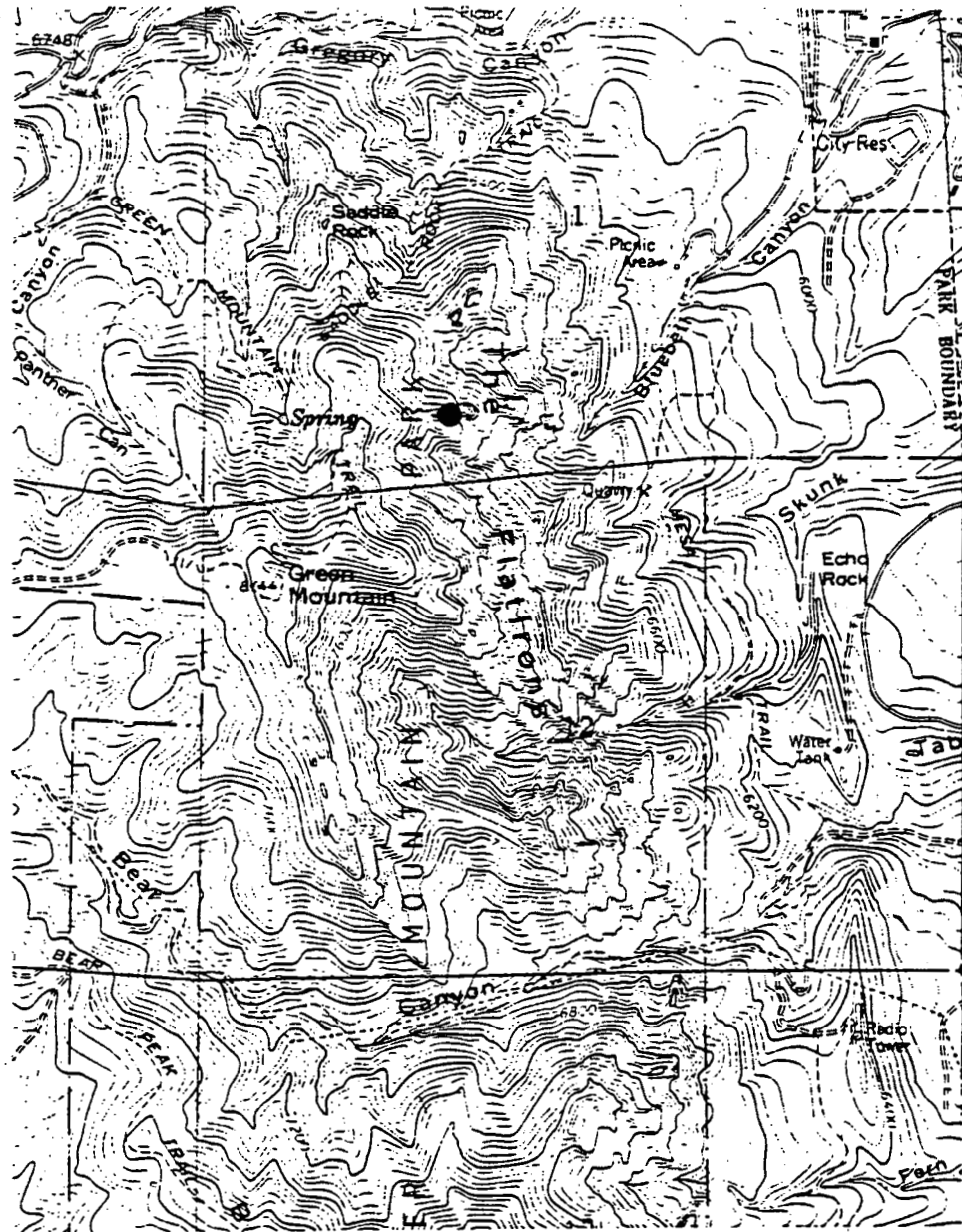


Figure 5. Turkey Vulture Nest , 1992-93.

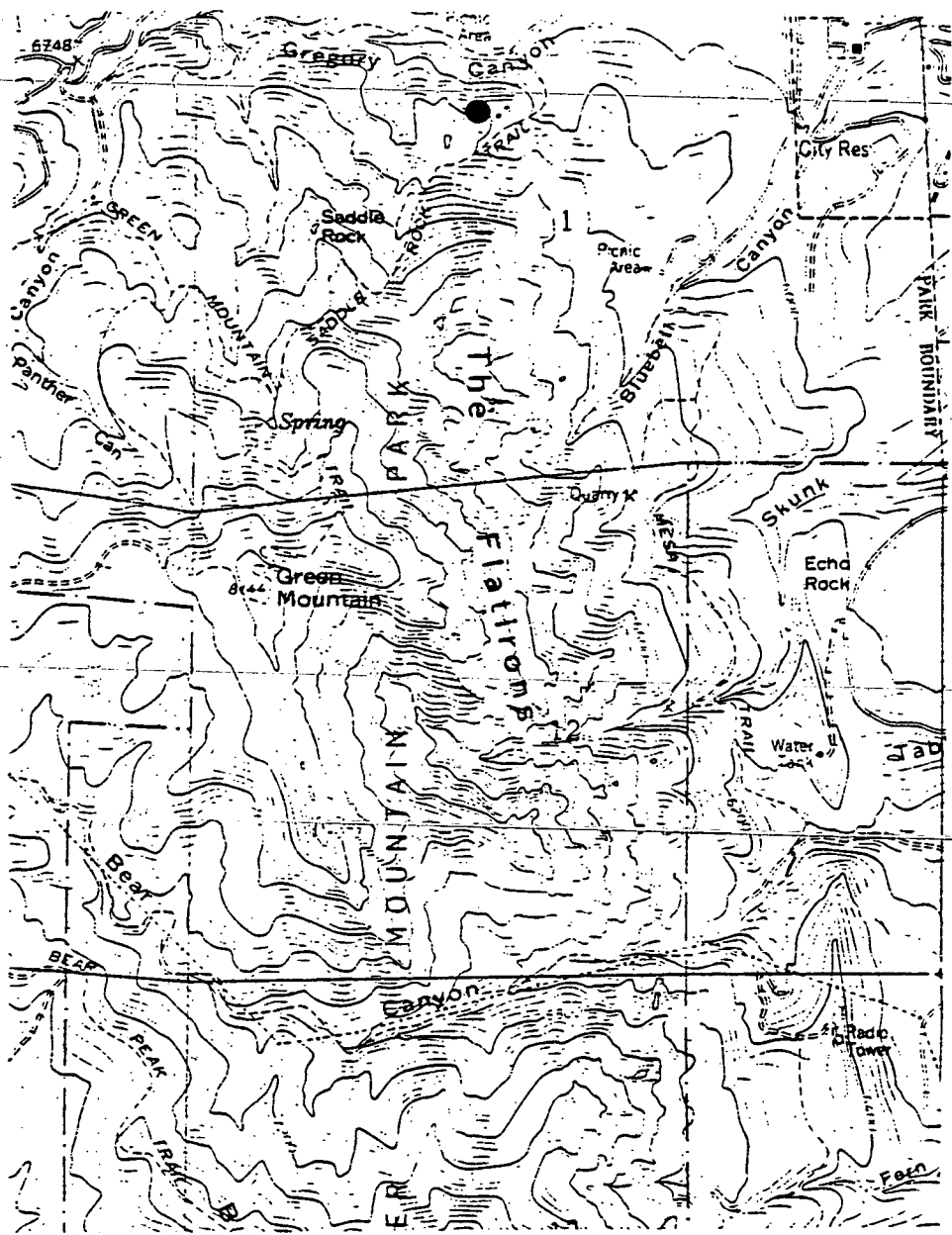


Figure 6. Great Horned Owl Nest, 1988.

Other Cliff Nesting Birds

Canyon wrens nest on steep, usually south-facing cliffs throughout the Park (Figure 7). They frequently construct their nests close to the ground in caves or deep recesses. During the 1995 breeding season, I observed singing canyon wrens in Gregory Canyon, on the Second Flatiron, on the Third Flatiron, on the Fourth Flatiron, on Dinosaur Mountain, near Mallory Cave, and in Bear Canyon.

Rock wrens nest in boulder fields and rubble piles throughout the Mountain Park (Figure 8). During the 1995 breeding season, I observed singing rock wrens on the First Flatiron, at Wood's Quarry, below Royal Arch, and on Dinosaur Mountain, below the Front Porch rock formation.

White-throated swifts and violet-green swallows nest colonially on some of the steepest and highest cliffs. A large colony of white-throated swifts nests on the northwest face of the Third Flatiron. Violet-green swallow nesting colonies are scattered throughout the Park.

Accipiters

Northern goshawks, Cooper's hawks, and sharp-shinned hawks nest in relatively dense ponderosa pine/Douglas-fir stands in remote areas of the Mountain Park (Jones 1989). Northern goshawks have nested near Wood's Quarry and in Lost Gulch. Cooper's hawks have nested in Ranger Canyon and on Dinosaur Mountain. Sharp-shinned hawks have nested in Fern Canyon (Figure 9). During 1995 raptor reconnaissance and accipiter surveys, I observed no accipiters in any of the drainages between Gregory Canyon and Bear Canyon. I observed a single northern goshawk in Long Canyon in August, 1995, and Steve Armstead observed a northern goshawk in

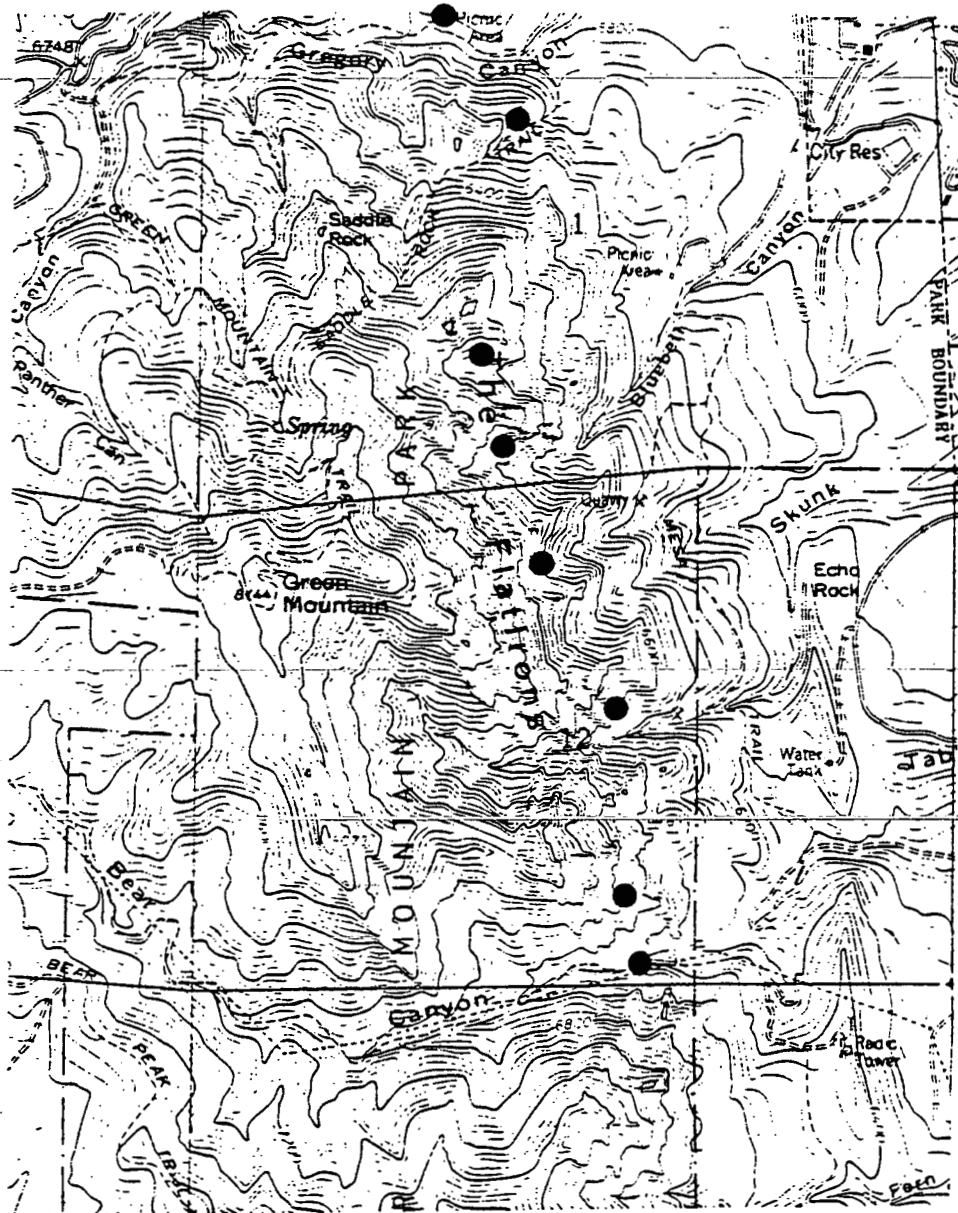


Figure 7. Canyon Wren Territories, 1995.

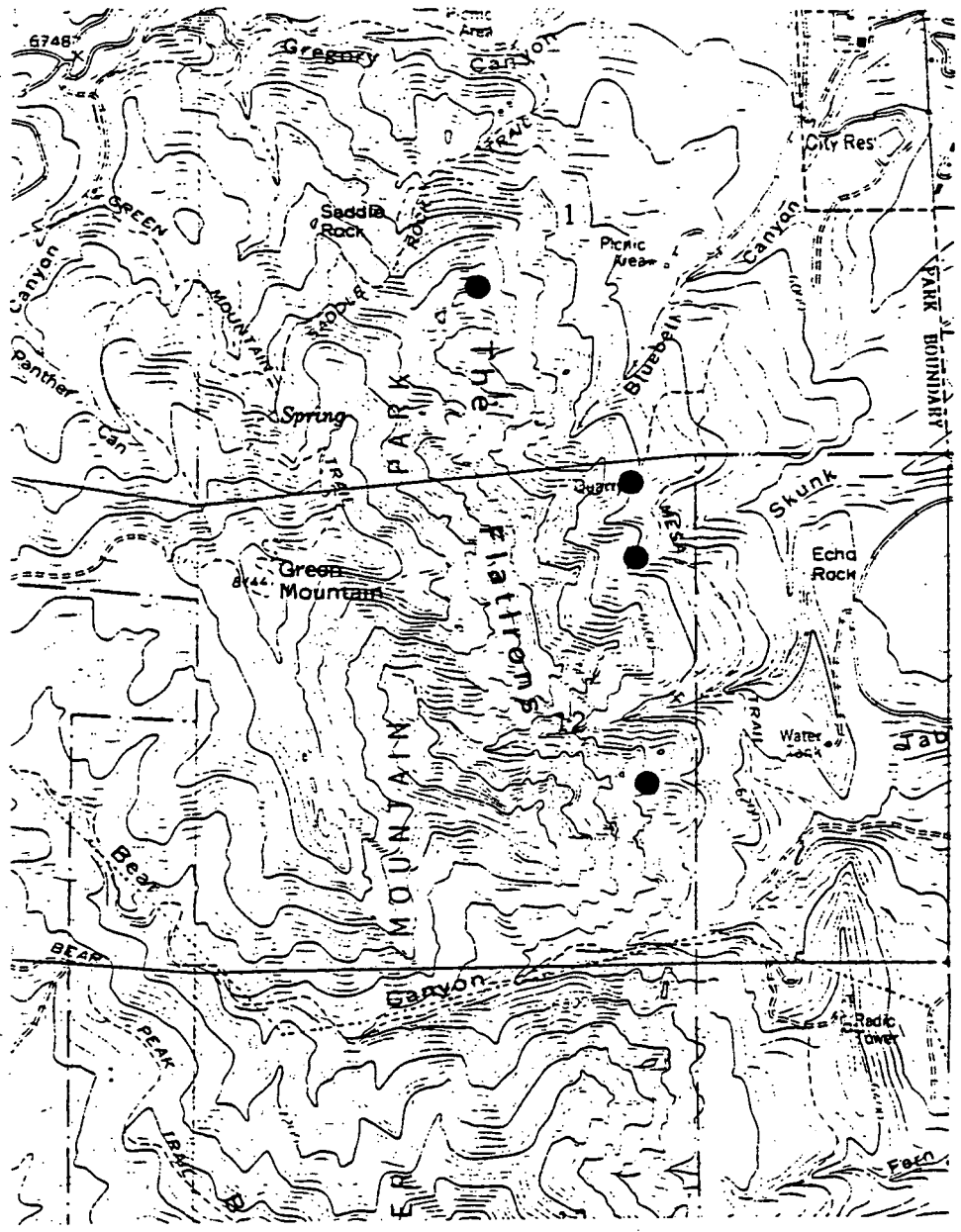


Figure 8. Rock Wren Territories, 1995.

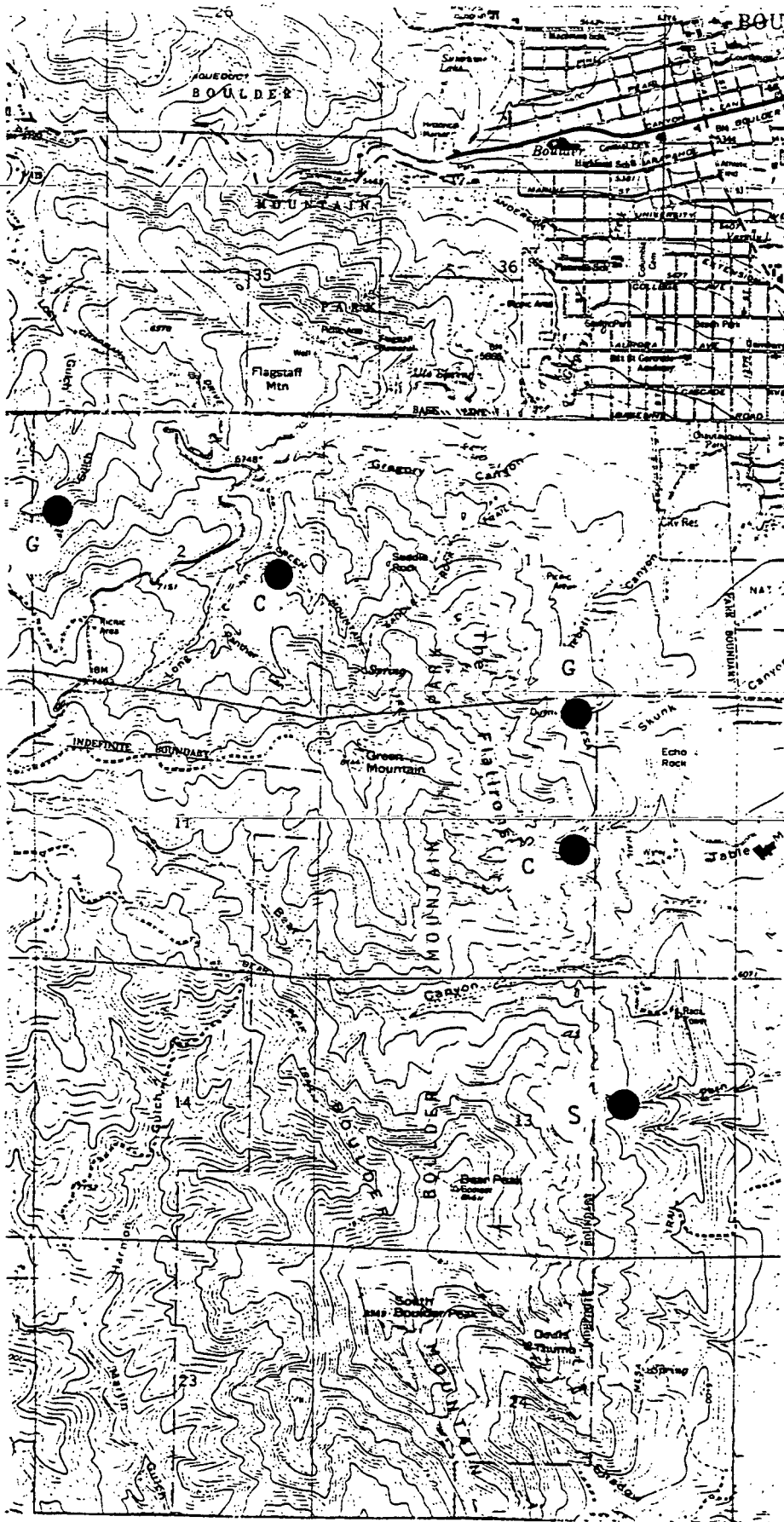


Figure 9. Accipiter Nest Sites, 1978-90.

G--Goshawk C--Cooper's Hawk S--Sharp-shinned Hawk

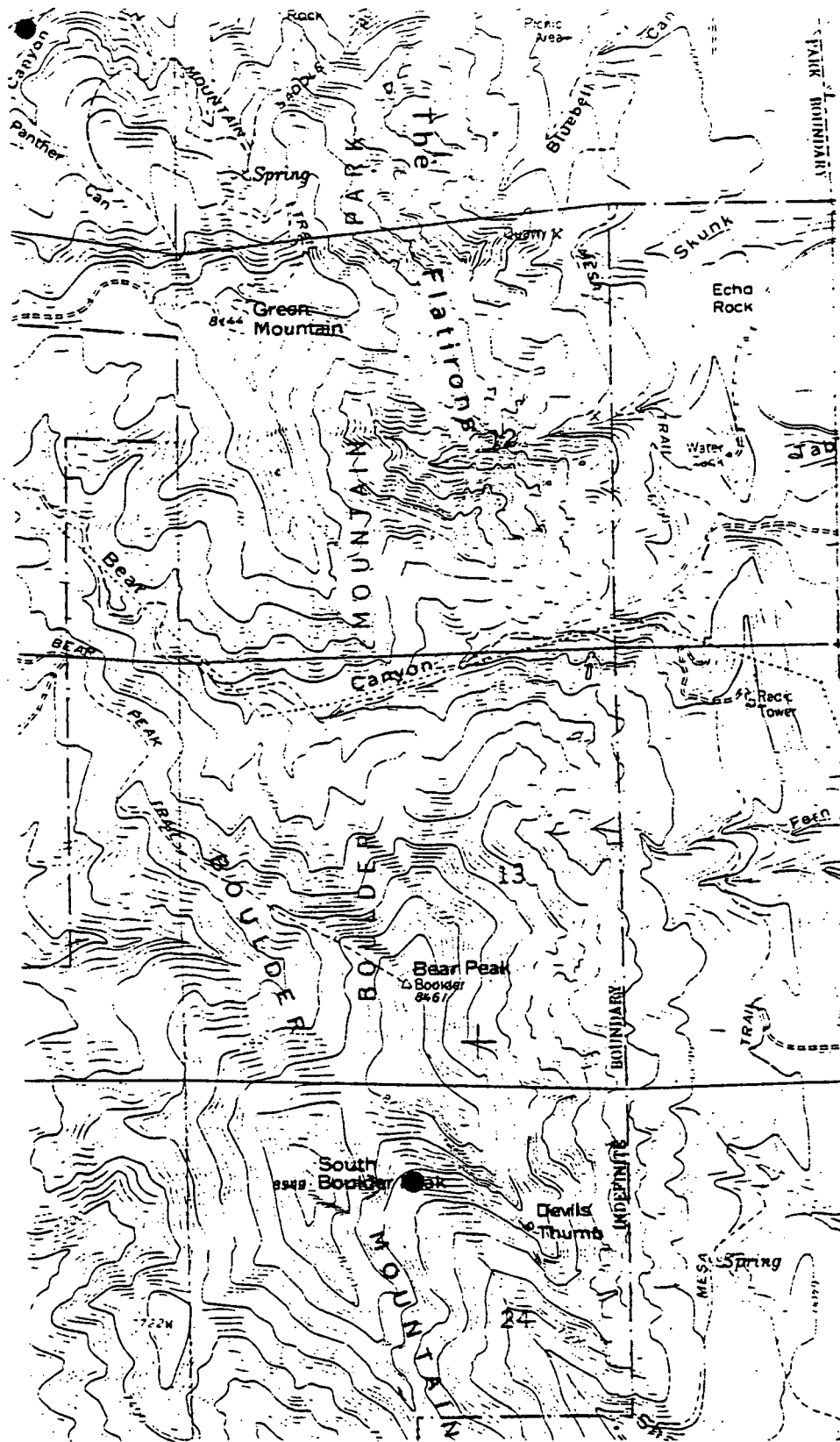


Figure 10. Northern Goshawk Sighting Locations, 1995.

upper Shadow Canyon in May, 1995 (Figure 10). No accipiter nesting activity within the Park was reported by Mountain Park rangers or raptor nest monitoring volunteers during the 1995 breeding season. During the 1996 breeding season, I observed sharp-shinned hawks on Enchanted Mesa and in Shanahan Canyon, east of Bear Peak. Volunteers reported two northern goshawk sightings in Gregory Canyon (Figure 10a and 10b).

Accipiter populations have declined throughout much of North America (Tate 1986, Reynolds 1989). Destruction and fragmentation of nesting and foraging habitat by logging and construction activities, along with shooting of migrating accipiters in the United States, Mexico, and Central America, appear to pose the greatest threats to accipiter populations (Reynolds 1989). In the Boulder Mountain Park, nesting habitat has been preserved. Thus, the absence of accipiter sightings or nesting reports in 1995 and 1996 is puzzling. Further study is needed to determine whether this lack of observations signals a decline in Mountain Park accipiter populations.

Breeding Birds of Special Concern

The Boulder County Parks and Open Space Department's Breeding Bird Species of Special Concern list (Boulder County Parks and Open Space 1994) includes species that fall into one or more of the following categories:

- I. Rare and declining
- II. Declining but not yet rare
- III. Rare and stable
- IV. Extirpated
- V. Isolated or restricted populations

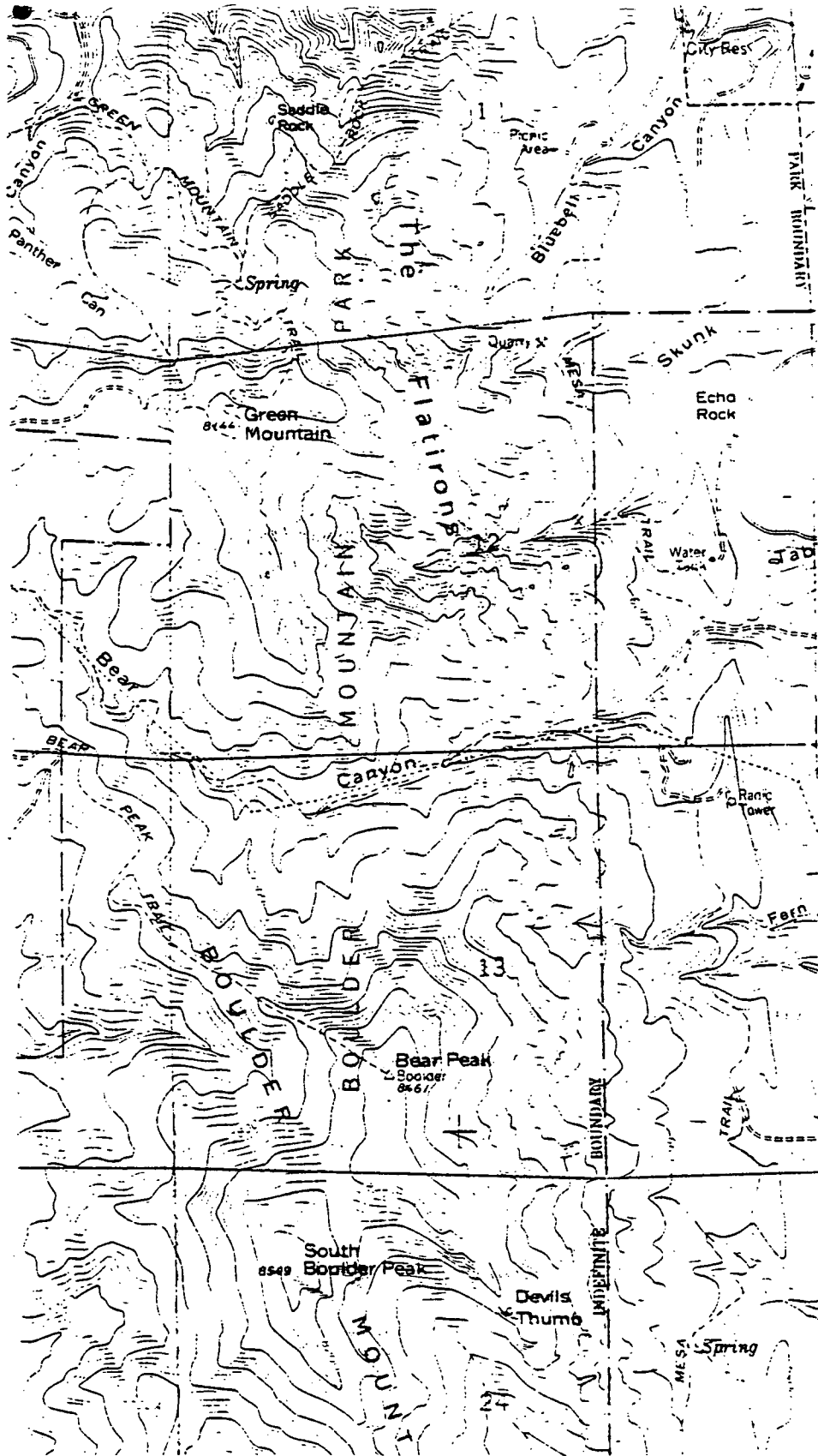


Figure 10a: Northern Goshawk Sighting Locations, 1996.

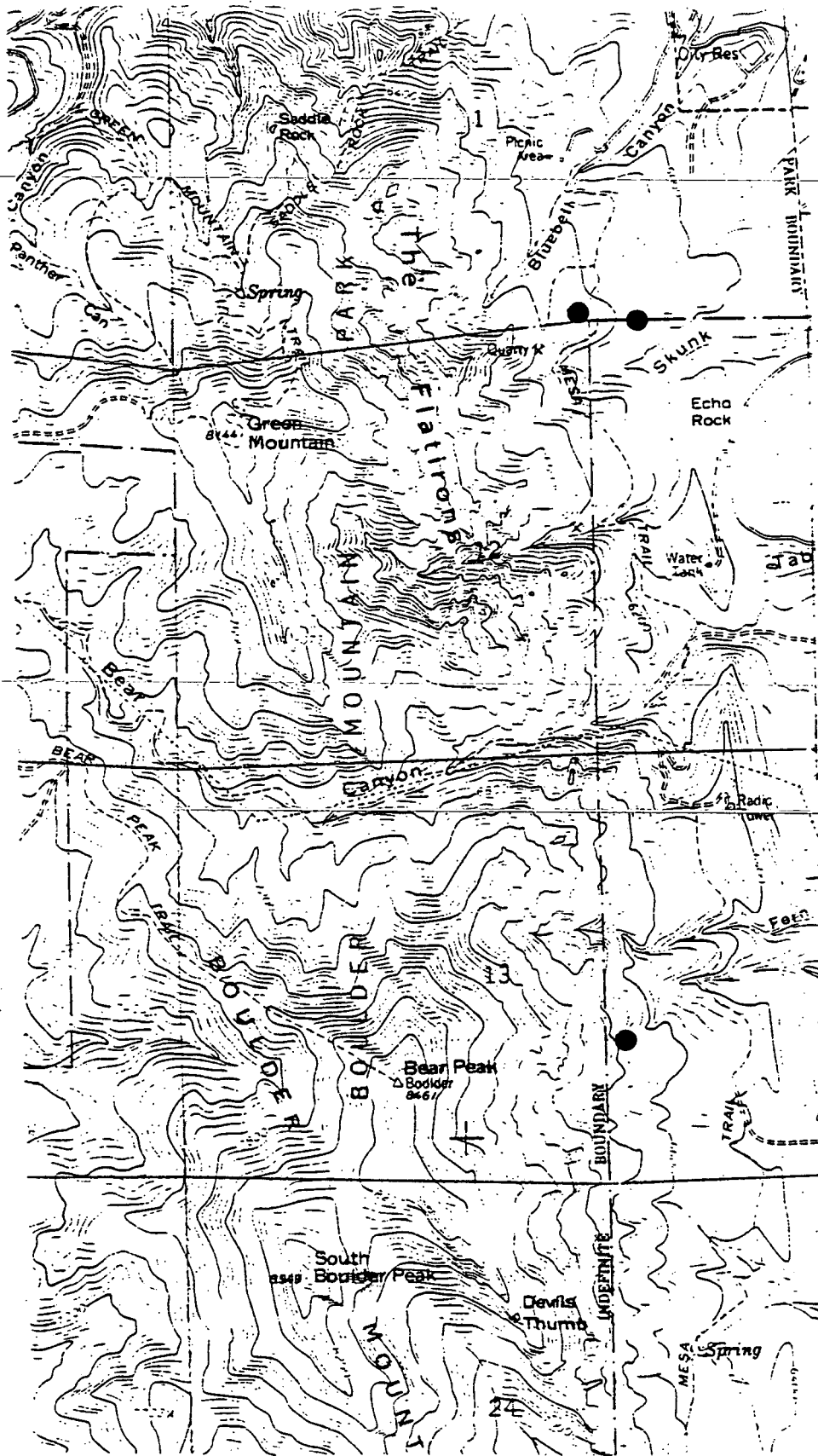


Figure 10b: Sharp-shinned Hawk Sighting Locations, 1996.

VI. Additional national or statewide concern

A total of 10 species from this list appear to nest within the study area. Species accounts follow.

1. Sharp-shinned Hawk VI (Audubon Blue List)

Sharp-shinned hawks were observed within the study area during 1989 and 1990, and a sharp-shinned hawk nest was reported in Fern Canyon by Howard Weinberg in 1987 (Figure 9). I observed three sharp-shinned hawks within the study area during the 1996 breeding season. Sharp-shinned hawks nest in a variety of forest types throughout the western United States. In Colorado they typically nest in dense stands of ponderosa pine, lodgepole pine, or Douglas-fir (Reynolds 1989). Most nests observed by Weinberg (1987) in Boulder County occurred on north-facing slopes supporting dense stands of Douglas-fir. Known sharp-shinned hawk nest sites throughout the Park should be protected and monitored periodically for human disturbance.

2. Cooper's Hawk VI (Audubon Blue List)

Cooper's hawks occur throughout temperate North America, nesting in deciduous, coniferous, and mixed forests (Reynolds 1989). In Boulder County they typically nest in mixed conifer stands on predominantly north-facing slopes in the foothills and lower mountains (Weinberg 1987). In the Boulder Mountain Park, they have nested in Ranger Canyon and on Dinosaur Mountain (Weinberg 1987—Figure 9). Cooper's hawk nesting sites within the Park should be protected and monitored periodically for human disturbance.

3. Northern Goshawk II (Declining but not yet rare)

Northern goshawks nest throughout mountainous regions of western North America, preferring older forests containing large trees for nesting and open areas for foraging (Reynolds 1989). In Boulder County they nest from the lower foothills to the lower sub-alpine life zone (Weinberg 1987, Hallock 1994). Ann Wichmann observed a northern goshawk nest near Wood's Quarry, in the Boulder Mountain Park, in 1976, and a pair has nested in Lost Gulch from 1989 to 1993. This site was inactive in 1996 (Jones 1990, pers. obs.). Two northern goshawk breeding season sightings were reported in Gregory in 1996. Northern goshawk nest sites within the Park should be protected from human disturbance and monitored periodically.

4. Golden Eagle V (Isolated or restricted populations)

Golden eagles have nested in the Boulder Mountain Park, in Skunk Canyon, on Bear Peak, and on South Boulder Peak (Armstead and Lederer 1995). The Skunk Canyon territory has been active each year since 1982. The Bear Peak site, which was described by Gale in 1889 (Henderson 1907), has not been active during recent years. The South Boulder Peak site was last active during 1984 (Armstead and Lederer 1995). Since 1987, Parks staff has closed upper Skunk Canyon to climbers, Feb.-July, to protect nesting eagles. Climbers have generally complied with this restriction (Steve Armstead, pers. commun.).

The Skunk Canyon nest site is one of only about ten known golden eagle nest sites in Boulder County. Staff should continue to monitor this site annually and institute closures, as necessary, to protect nesting eagles.

5. Peregrine Falcon III, (Rare and stable), V (Isolated or restricted populations)

Although peregrine falcons nested historically in the Boulder Mountain Park, no nesting pairs were observed from 1958-1990. In 1991, a pair nested in Shadow Canyon, fledging three young. This territory was active from 1991-96. A second territory, on the Third Flatiron, was active from 1994-96 (Figure 2, Armstead and Lederer 1995). Staff has instituted climbing route closures and a nest monitoring program to protect nesting peregrine falcons. This program has been successful in protecting existing nests and should be continued.

6. Prairie Falcon V (Isolated or restricted populations)

Prairie falcons have nested at five locations within the Mountain Park (Figure 3). Nesting success has declined from a high of 4 attempted nestings and 13 fledged young in 1987 to 2 attempted nestings and 3 fledged young in 1996 (Armstead and Lederer 1995). The greatest threat to prairie falcon nesting populations appears to be displacement by peregrine falcons and common ravens. Staff should continue to carefully monitor nesting prairie falcon populations and institute climbing route closures as necessary to protect active nests.

7. Flammulated Owl V (Isolated or restricted populations)

Flammulated owls nest in isolated foothills canyons containing late successional or old-growth ponderosa pine/Douglas-fir forests (Reynolds and Linkhart 1987). They were considered rare in Boulder County until recently, when isolated populations were discovered in the Boulder Mountain Park and in North St. Vrain Canyon (Jones 1991). In the Flatirons region of the Mountain Park, flammulated owls nest in upper Bluebell Canyon, upper Skunk Canyon, Bear Canyon, Shadow Canyon, and in the unnamed canyon between the Second and Third Flatirons (Figure 11). These owls generally nest in areas containing large diameter live ponderosa pines, large diameter snags, and relatively dense shrub vegetation (Reynolds and Linkhart 1987, Jones

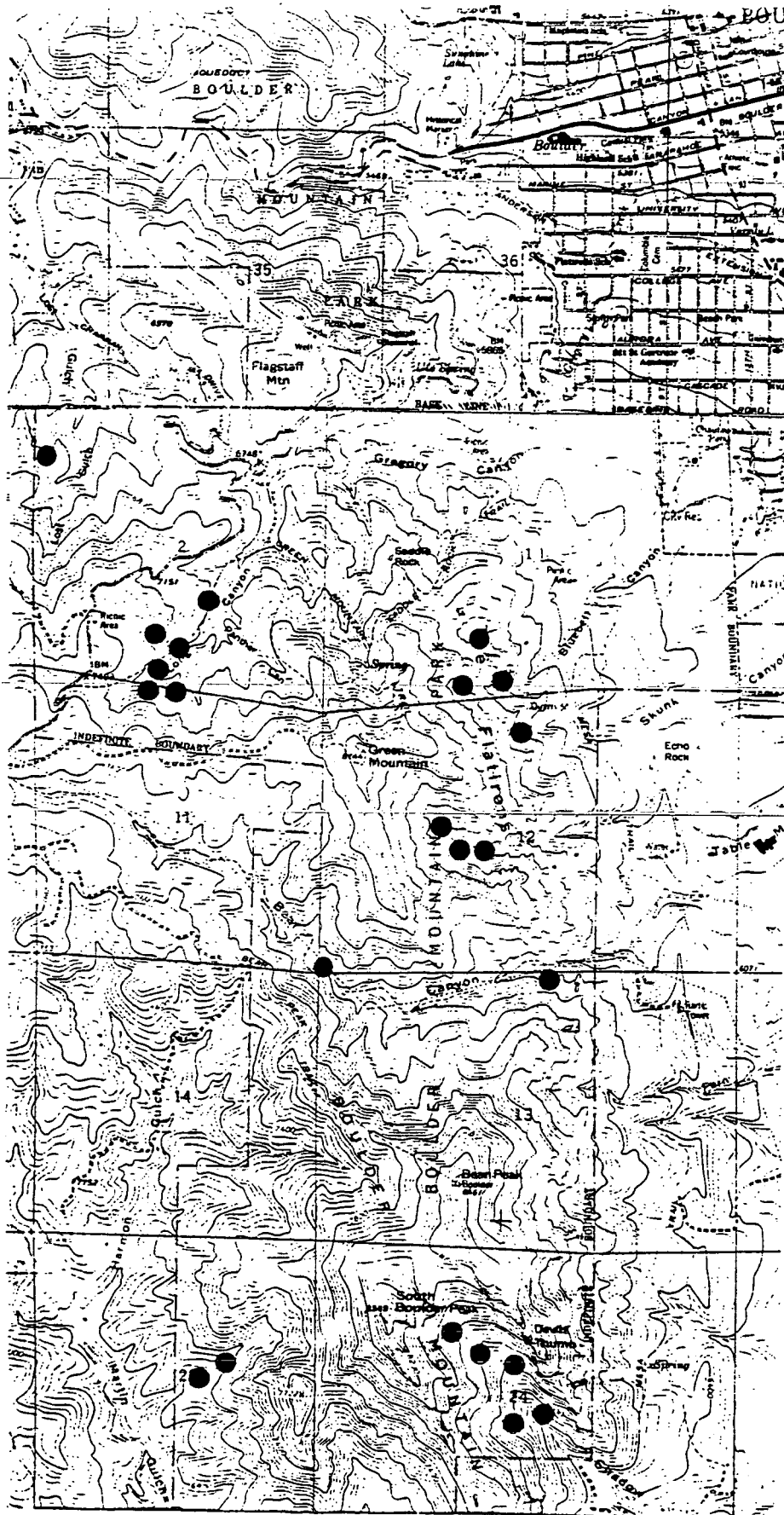


Figure 11. Flammulated Owl Distribution, 1988-93. Each dot represents one singing male during one breeding season.

1991). They lay their eggs in cavities excavated by woodpeckers in aspens or ponderosa pines.

They may require large diameter live trees for roosting (Reynolds and Linkhart 1987).

Recreational activities should have little impact on this species. Natural replacement of snags should sustain adequate snag densities for flammulated owls in these canyons.

8. Common Nighthawk VI (Audubon Blue List)

Nesting status of common nighthawks in the Boulder Mountain Park is unknown. Though this species is occasionally seen in the Flatirons Canyons, pairs probably nest farther east, on the mesas and plains.

9. Hairy Woodpecker VI (Audubon Blue List)

Hairy woodpecker populations appear to be steady or increasing within the Mountain Park (Jones 1989). They nest on mesas and in canyons throughout the Mountain Park. Hairy woodpeckers prefer large, broken top snags with evidence of heart rot (Short 1982).

Recreational activities should have little impact on this species. Natural snag recruitment should be adequate to maintain nesting populations in the Flatirons Canyons.

10. Yellow Warbler VI (Audubon Blue List)

Yellow warblers are thought to be declining nationally (Tate 1986). Andrews and Righter (1992) classified them as common to fairly common summer residents throughout much of Colorado. Yellow warblers nest in a variety of settings, including second-growth woodlands, gardens, shrublands, and riparian thickets (Ehrlich et al 1988). I observed singing yellow warblers in Bear Canyon and Gregory Canyon.

Preservation of cottonwoods and willows in Bear Canyon and Gregory Canyon should benefit this species.

Mammals

Table 5 lists mammals known to be present in Flatirons canyons during 1995 or 1996. These species represent a small fraction of the mammal population of these canyons. Extensive nocturnal surveys, tracking surveys, and small mammal trapping would be necessary to generate a comprehensive list.

Black bears were present in all of the ten canyons. Gregory and Bear Canyons may serve as migration routes for black bears moving down into the foothills in late summer and fall to forage on wild fruits (Figure 12). The majority of black bear sightings reported to the Mountain Park rangers from 1991-95 occurred in foothills canyons. Few black bear sightings were reported in the smaller canyons that cut through the Flatirons.

Almost nothing is known about black bear denning habits in Boulder County. Black bears are present in the Mountain Park throughout the fall months, and the caves and hollows of the Flatirons rock formation would appear to provide suitable denning sites. Goodrich and Berger (1994) found that bears hibernating in the mountains of eastern California and western Nevada occasionally abandon dens and cubs in response to investigator disturbance. They concluded that an increase in winter recreational activities in mountain forests may threaten black bear populations. Mountain Park staff may wish to instigate a radio collaring and tracking

Table 5. Mammal Observations, May - November, 1995.¹

● Mammal observed, or mammal scat or sign observed.

- | | | |
|---------------------|--------------------|----------------------|
| 1. 1st Flatiron | 4. Bluebell Canyon | 7. Skunk Canyon |
| 2. 1st/2nd Flatiron | 5. Tangen Spring | 8. Dinosaur Mountain |
| 3. 2nd/3rd Flatiron | 6. Royal Arch | 9. Bear Canyon |
| | | 12. The Slab |

Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#12
Cottontail Species					X	X			X	X
Chipmunk Species		X	X	X		X	X	X	X	
Yellow-bellied Marmot	X									
Golden-mantled Ground Squirrel	X					X	X	X		
Abert's Squirrel		X					X			X
Chickaree (Pine Squirrel)	X	X	X	X	X	X	X	X	X	X
Porcupine								X	X	
Coyote									X	
Black Bear	X	X	X	X	X	X	X	X	X	X
Mountain Lion	X	X	X	X	X		X	X	X	
Mule Deer	X	X	X		X			X	X	X

¹Also includes predator sightings reported to Mountain Park rangers.

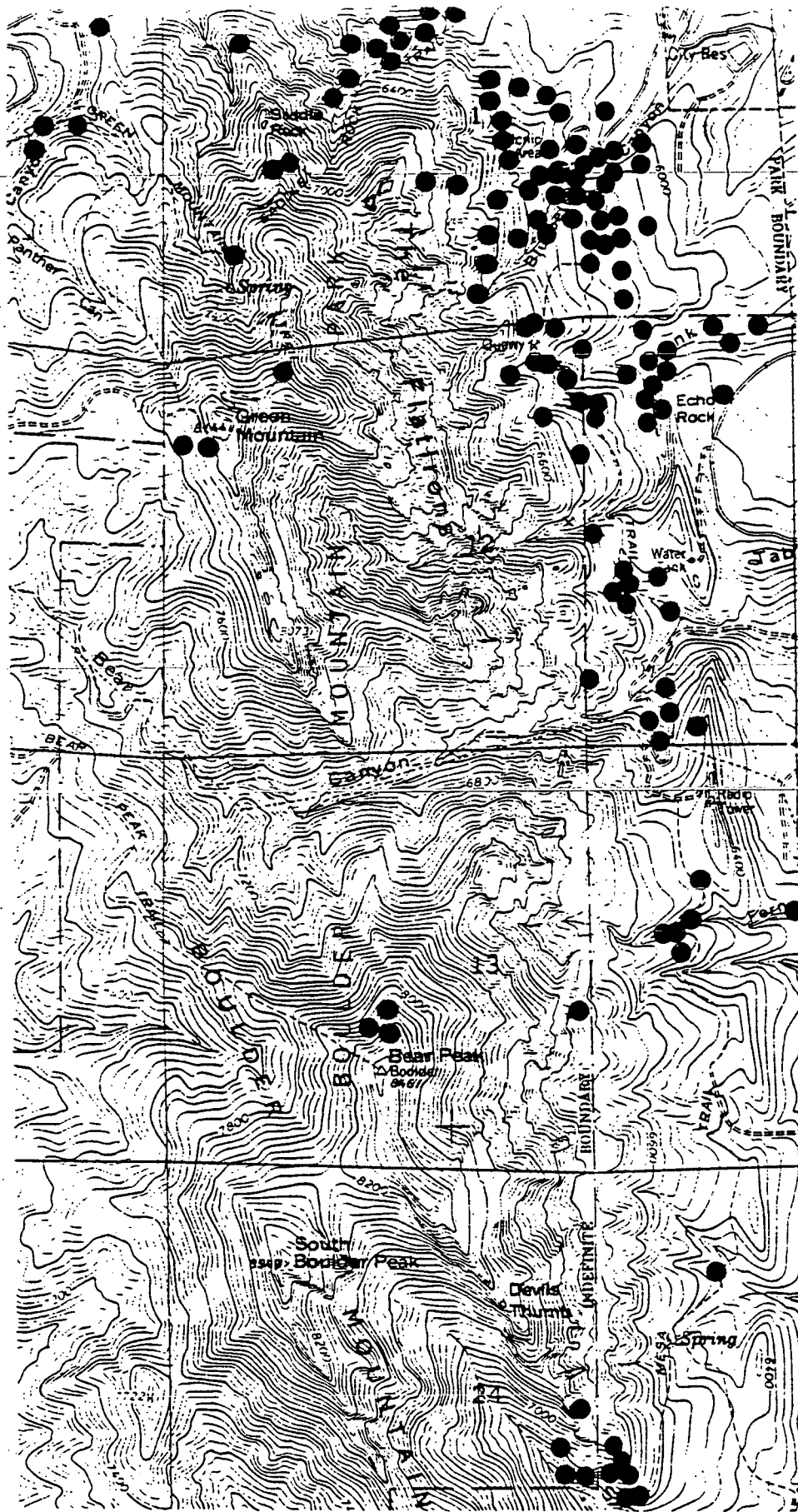


Figure 12. Black Bear Sightings, 1991-95.

program to discover whether black bears den within the Park and to determine whether active dens should be protected from recreational users.

Mountain lions were present in at least 8 of the 13 canyons. Most mountain lion sightings reported to the Mountain Park rangers from 1991-96 occurred in the lower canyons and on the mesas where deer populations are highest (Figure 13). Mountain lions were infrequently seen in the smaller canyons that cut through the Flatirons.

Mountain lions will avoid areas where the forest has been disturbed from logging, road construction, or trail construction (Van Dyke 1986, Smallwood 1994). During the past ten years, mountain lion-human interactions in Boulder County have increased in frequency and intensity, with the lions often displaying aggressive or confrontational behavior (Halfpenny and Sanders 1993). Since deer populations in the Flatirons canyons are relatively low, mountain lion activity in this region is probably low, as well. Nevertheless, staff should continue to post signs warning recreational users of the potential dangers posed by mountain lions.

Porcupine populations in the Mountain Park appear to be low. During May-November, 1995, surveys, I observed clear evidence of porcupine activity (scat or stripped bark on conifers) in only two of the nine drainages. Sweitzer and Berger (1992) found that porcupines living in the Great Basin Desert avoided areas where domestic dogs were present, even if avoidance forced them into areas with lower foraging potential. Staff may wish to organize a winter tracking program to assess the status of porcupines in the Mountain Park.

For the past three years, City of Boulder Mountain Parks and Open Space staff have carried out a bat survey. A total of nine bat species have been observed on Mountain Park or Open Space land: western small footed myotis, long-eared myotis, little brown bat, fringed myotis, long-legged myotis, hoary bat, silver haired bat, big brown bat, Townsend's big-eared bat

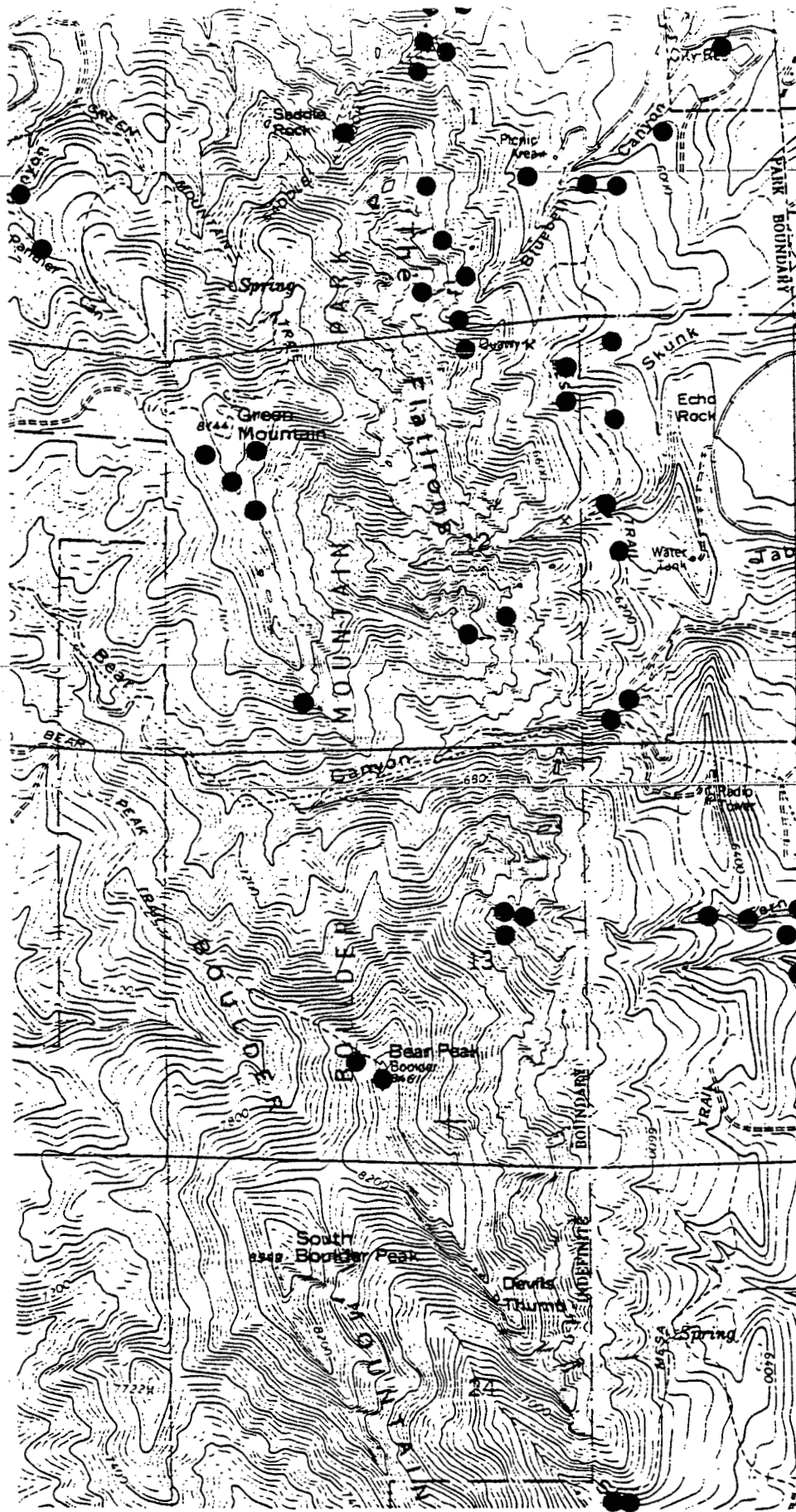


Figure 13. Mountain Lion Sightings, 1991-95.

(Adams 1996). Disturbance of roost sites and hibernacula by recreationists has decimated bat populations throughout North America (Armstrong et al 1994). Staff has taken steps to protect a Townsend's big-eared bat maternal roost in Harmon Cave, near Bear Canyon, and should continue to search for and protect additional sites.

Table 6 lists Boulder County and Colorado mammalian species of special concern likely to occur within the Mountain Park (Boulder County Comprehensive Plan 1987). At least 13 of these species could potentially occur in the Flatirons region. Many of these species occur hypothetically. I recommend that staff consider a long term small mammal live trapping program to gain a better understanding of mountain park mammal populations.

Table 6. Mammals of Special Interest in the Boulder Mountain Park

Scientific Name	Common Name	Status	Class	Habitat
<u>Didelphis marsupialis</u>	Virginia Opossum	D	4,5	R
<u>Sorex nanus</u>	Dwarf Shrew	H	5	A,C,D,N,R
<u>Sorex palustris</u>	Water Shrew	D	4	A,C,R
<u>Sorex merriami</u>	Merriam's Shrew	D	4,5	C,D
<u>Cryptotis parva</u>	Least Shrew	D	4	G,R
<u>Myotis thysanodes</u>	Fringed Myotis	H	5	C
<u>Sylvilagus floridanus</u>	Eastern Cottontail	H	5	R
<u>Lepus townsendii</u>	White-tailed Jackrabbit	D	3,5	A,C,N
<u>Eutamias umbrinus</u>	Uinta Chipmunk	D	5	A,C,N
<u>Spermophilus tridecemlineatus</u>	13-line Ground Squirrel	D	4	G
<u>Spermophilus spilosoma</u>	Spotted Ground Squirrel	D	4,5	G
<u>Spermophilus variegatus</u>	Rock Squirrel	D	4	C,D,R
<u>Sciurus aberti</u>	Abert's Squirrel	D	4	C
<u>Geomys bursarius</u>	Plains Pocket Gopher	H	4,5	G
<u>Perognathus fasciatus</u>	Olive-backed Pocket Mouse	H	4,5	C,G

Status: D-Documented by specimen or certain observation in Boulder Parks and Open Space, H--Hypothetical but strongly expected. E--Extirpated within historic times.

Classification: 1 - Extirpated species, 2 - Threatened/Endangered, 3 - Non-cyclical declines, 4 - Restricted habitats, 5 - Undetermined Status.

Habitat: A--Aspen, C--Coniferous Forest, D--Dry Scrub, G--Grassland, N--Rock and Talus, R--Riparian.

¹From Armstrong, D., "Potential natural mammalian fauna of Boulder Mountain Parks," in

Scientific Name	Common Name	Status	Class	Habitat
<u>Perognathus flavescens</u>	Plains Pocket Mouse	H	4,5	G
<u>Perognathus hispidus</u>	Hispid Pocket Mouse	D	4,5	G
<u>Dipodomys ordii</u>	Ord's Kangaroo Rat	H	4,5	G
<u>Castor canadensis</u>	Beaver	D	4	R
<u>Reithrodontomys montanus</u>	Plains Harvest Mouse	H	5	G
<u>Peromyscus difficilis</u>	Rock Mouse	D	4	C,D
<u>Onychomys leucogaster</u>	Northern Grasshopper Mouse	H	5	G
<u>Phenacomys intermedius</u>	Heather Vole	H	4,5	A,C,R
<u>Microtus pennsylvanicus</u>	Meadow Vole	D	4	A,R
<u>Ondatra zibethicus</u>	Muskrat	D	4	R
<u>Zapus hudsonius</u>	Meadow Jumping Mouse	H	4,5	R
<u>Canis lupus</u>	Gray Wolf	E	1	A,C,D,G,N,R
<u>Vulpes velox</u>	Swift Fox	H	4,5	G
<u>Urocyon cinereoargenteus</u>	Gray Fox	D	4	C,D,N
<u>Ursus arctos</u>	Grizzly Bear	E	1,2,A,B	A,C,D,G,N,R
<u>Bassariscus astutus</u>	Ringtail	H	5	D,N
<u>Mustela nigripes</u>	Black-footed Ferret	E	2,A,B	G
<u>Gulo gulo</u>	Wolverine	E	2,B	C
<u>Lutra canadensis</u>	River Otter	E	1	R
<u>Felis canadensis</u>	Lynx	E	2,B	C
<u>Felis rufus</u>	Bobcat	D	3	C,D,N,R
<u>Antilocapra americana</u>	Pronghorn	E	1	G
<u>Bison bison</u>	Bison	E	1	C,G

MANAGEMENT

Heavy recreational use of the Flatirons and their associated canyons poses a potential threat to cliff-nesting raptors, ground and shrub-nesting birds, as well as foraging and denning mammals. Mountain Park staff has used a variety of methods, including closure of some climbing routes and canyons, signage warning hikers away from black bear foraging areas, and trail realignments, to protect wildlife. The following recommendations are intended to supplement, rather than replace, existing management efforts.

1. First Flatiron and Contact Canyon

Breeding bird plot density: species 6, individuals 10.

Breeding birds of special concern: peregrine falcon (perches), prairie falcon (perches).

Large mammals: black bear, mountain lion, mule deer.

Natural Features: This area is dominated by second-growth Douglas-fir forest growing on steep north-facing slopes. Prairie falcons and peregrine falcons perch on the north face of the First Flatiron, and common ravens have nested there. A small marmot colony inhabits the grassy slope below Saddle Rock. Hermit thrushes nest in the Douglas-firs below the First Flatiron.

Management: A number of social trails leading from the Saddle Rock Trail to the First Flatiron summit have caused extensive erosion. Many hikers may not be aware of an existence of a maintained trail connecting Saddle Rock Trail with the saddle between the First and Second

Flatirons. Staff may wish to place signs between the Amphitheater and Contact Canyon advising hikers to stay on maintained trails.

2. First/Second Flatiron

Breeding bird plot density: 11.5 species, 15.5 individuals.

Breeding birds of special concern: peregrine falcon (perches), prairie falcon (perches).

Large mammals: mountain lion, black bear, mule deer.

Natural features: The narrow chute between the First and Second Flatirons is dominated by ponderosa pine/Douglas-fir forest. Rock wrens nest near the bottom of the east face of the First Flatiron. Cooper's hawks have been reported in this area, but no nesting activity has been observed. Peregrine falcons and prairie falcons perch on the South Block of the Second Flatiron.

Management: A newly constructed trail has greatly reduced erosion in this area. The trail needs to be more clearly marked so that hikers do not wander off onto the steep and easily erodible slope between the First and Second Flatirons. Recreational activity in this area should have little impact on prairie or peregrine falcons nesting on the Third Flatiron.

3. Second/Third Flatiron

Breeding bird plot density: 13.5 species, 26 individuals.

Breeding birds of special concern: peregrine falcon (perches), prairie falcon (perches), flammulated owl (territory).

Large mammals: mountain lion, black bear, mule deer.

Natural features: The ponderosa pine/Douglas-fir forest growing in the canyon between the Second and Third Flatirons supports a high density of breeding birds. Flammulated owls and

common flickers roost and probably nest in the large snags occurring on the north side of the canyon. Canyon wrens nest on the north face of the Second Flatiron. A large colony of white-throated swifts nests on the northwest face of the Third Flatiron. Peregrine falcons that nested on the south face of the Third Flatiron in 1994-96 frequently fly over this area and perch on the summits of the First and Second Ironing Boards. Mountain lions and black bears have been sighted near the Second/Third Flatiron trail junction.

Management: Seasonal closure of this canyon to recreational users will help to protect nesting peregrine falcons. Currently there are at least three social trails running up this canyon. Staff may wish to deter erosion by consolidating these three trails into a single, well marked and maintained trail.

4. Upper Bluebell Canyon

Breeding bird plot density: 12 species, 32 individuals.

Breeding birds of special concern: peregrine falcon (nest), prairie falcon (historic nests), flammulated owl (territory).

Large mammals: black bear, mountain lion.

Natural features: Relatively dense riparian growth along upper Bluebell Creek supports nesting MacGillivray's warblers and provides potential nesting habitat for ovenbirds. Prairie falcons (until 1993) and peregrine falcons (1994-95) nest on the south face of the Third Flatiron. White-throated swifts, violet-green swallows, and canyon wrens also nest on the Third Flatiron. A turkey vulture nest between the First and Second Ironing Boards in 1992-93 was only the second turkey vulture nest ever reported in Boulder County. Flammulated owls occupy snags on

the south side of the canyon. Mountain lions and black bears have been sighted along the Royal Arch Trail.

Management: I recommend continued seasonal closures of this canyon to protect nesting falcons. I do not recommend additional trail construction, as it would only attract more recreational users to this area. It would be desirable to encourage climbers descending from the Third Flatiron to use the trail running along the north side of the Third Flatiron, rather than descending through this relatively lush and fragile canyon.

5. Tangen Spring and Fourth Flatiron

Breeding bird plot density: 12 species, 17 individuals.

Breeding birds of special concern: northern goshawk (historic nest), flammulated owl (territory).

Large mammals: mountain lion, black bear, mule deer.

Natural features: The canyon running from Tangen Spring to Wood's Quarry contains a mix of ponderosa pine and Douglas-fir that supports moderate densities of breeding birds.

Northern goshawks nested near Wood's Quarry in 1976. Canyon wrens nest on the Fourth Flatiron. Rock wrens nest above Wood's Quarry. Flammulated owls and common poorwills have also been observed in this area. Mountain lions and black bears have been sighted near Wood's Quarry.

Management: This area receives moderate recreational use, but most users stay on the Royal Arch Trail. The social trail connecting Wood's Quarry to the Royal Arch Trail should remain closed.

6. Royal Arch

Breeding bird plot density: 13 species, 16 individuals.

Breeding birds of special concern: hairy woodpecker.

Large mammals: black bear, mule deer.

Natural features: This canyon is dominated by a relatively dense stand of Douglas-fir that supports forest interior bird species such as western flycatcher, red-breasted nuthatch, and blue grouse. Rock wrens nest in the rubble field immediately west of the Mesa Trail. Macgillivray's warblers nest in the riparian growth at the lower end of the canyon.

Management: This area receives little recreational use. A climber's trail running up the north side of the canyon has caused only moderate erosion. Therefore, no additional management appears necessary at this time.

7. Skunk Canyon

Breeding bird plot density: 8.5 species, 15.5 individuals.

Breeding bird species of special concern: golden eagle (nesting), flammulated owl.

Large mammals: mountain lion, black bear.

Natural features: Skunk Canyon contains the only active golden eagle nest in the Mountain Park. Canyon wrens nest on the north side of the canyon, and the relatively dense riparian growth along Skunk Creek supports a variety of shrub nesting and deciduous canopy nesting birds, including warbling vireo, Virginia's warbler, lazuli bunting, and rufous-sided towhee. Black bears forage in both the lower canyon (below the narrows) and the upper canyon. The upper canyon contains one of the most diverse fern populations and the densest lady-fern population in the Mountain Park.

Management: The closure of upper Skunk Canyon during the eagle nesting season has been mostly successful and should be continued. The upper canyon serves as a sanctuary for wildlife such as golden eagles and black bears, and I recommend that staff discourage all recreational incursions into this area.

8. Dinosaur Mountain

Breeding bird plot density: 12 species, 20.5 individuals.

Breeding bird species of special concern: Cooper's hawk, golden eagle (perches), prairie falcon (nest), hairy woodpecker.

Large mammals: mountain lion, black bear, mule deer.

Natural features: Cooper's hawks have nested in the Douglas-fir forest below the Front Porch rock formation. Prairie falcons nest on the Back Porch rock formation. The Skunk Canyon golden eagle pair frequently perches in this area. Riparian growth along the seasonal stream running down from the Front Porch rock formation supports a relatively high density of breeding birds, including broad-tailed hummingbirds, western flycatchers, warbling vireos, Virginia's warblers, MacGillivray's warbler, black-headed grosbeaks, and lazuli buntings. Both rock wrens and canyon wrens nest on cliffs on Dinosaur Mountain. Mountain lions and black bears have been sighted near the Mesa Trail.

Management: The social trail leading from the Mesa Trail to the Front Porch rock formation has caused considerable erosion. I recommend permanent closure of this trail. I recommend seasonal closure (during the prairie falcon nesting season) of the climber's trail running from the Mallory Cave Trail to the Back Porch rock formation. Staff should continue to monitor accipiter populations in this area.

9. Bear Canyon

Breeding bird plot density: 10.5 species, 17 individuals.

Breeding birds of special concern: prairie falcon (historic nest), flammulated owl (territory), hairy woodpecker.

Large mammals: black bear, mountain lion, coyote, mule deer.

Natural features: Because Bear Canyon is the only canyon that cuts all the way through the Flatirons from west to east, it serves as an important large mammal migration corridor. Black bears, mountain lions, and coyotes are frequently seen in this canyon. Prairie falcons nested on the north side of the canyon from

1984-88. Canyon wrens also nest in these cliffs. Dippers have nested along Bear Creek, below the narrows. The canyon, with its diverse vegetation, supports at least 50 species of breeding birds.

Management: Hikers should be discouraged from using the Bear Canyon Trail during the season of peak black bear activity, roughly August-October. Nesting raptor closures should be instituted as necessary.

10. Fern Canyon

Breeding bird plot density: 11.5 species, 24 individuals.

Breeding bird species of special concern: sharp-shinned hawk (historic nest), prairie falcon (nest).

Large mammals: black bear, mountain lion, coyote, mule deer.

Natural resources: Sharp-shinned hawks have nested in the dense Douglas-fir stand in lower Fern Canyon west of the Mesa Trail. Northern saw-whet owls and northern pygmy owls

also nest in this area. Prairie falcons nested on the north side of Fern Canyon from 1983-95.

White-throated swifts, violet-green swallows, and canyon wrens also nest in these cliffs.

Mountain lions and black bears have been sighted along the Fern Canyon Trail. Nearby, Harmon Cave supports a maternal colony of Townsend's big-eared bats.

Management: Staff has closed the area on the north side of Fern Canyon, from the Bear Peak Saddle down to the mouth of the canyon, during the raptor nesting season. This closure should be continued so long as raptors nest in the area. Nesting accipiters in lower Fern Canyon should be monitored. Staff is currently working on a plan to protect the bat colony in Harmon Cave.

11. Shadow Canyon

Breeding bird plot density: 13.5 species, 25.5 individuals.

Breeding bird species of special concern: peregrine falcon (nest), prairie falcon (historic nest), flammulated owl (territory), hairy woodpecker, yellow warbler.

Large mammals: mountain lion, black bear, coyote, mule deer.

Natural resources: Lower Shadow Canyon, with its near old-growth Douglas-fir forest, steep cliffs, and riparian vegetation, supports a high diversity of nesting birds, including several species of special concern. Prairie falcons (1983-93, 1996) and peregrine falcons (1993-96) nest in the cliffs on the north side of the canyon. White-throated swifts and canyon wrens also nest in these cliffs. Riparian vegetation along Shadow Canyon Creek supports lazuli buntings, western tanagers, MacGillivray's warblers, Virginia's warblers, yellow warblers, and warbling vireos.

Black bears are frequently sighted in lower Shadow Canyon.

Management: Seasonal closures on either side of Shadow Canyon trail should be continued, as necessary, to protect cliff-nesting raptors. Seasonal closures of Towhee Trail and Shadow Canyon Trail should be instituted, as necessary, to protect foraging black bears.

12. The Slab on Bear Peak

Breeding bird plot density: 12.5 species, 22.5 individuals.

Breeding bird species of special concern: sharp-shinned hawk, prairie falcon (roost), hairy woodpecker.

Large mammals: black bear, coyote, mule deer.

Natural resources: Snowmelt and rainwater draining off The Slab support a large area of bracken fern, wild raspberry, and near old-growth ponderosa pine forest. Black bears frequently forage in this area. Dense shrubbery at the base of The Slab supports nesting house wrens, Virginia's warblers, and MacGillivray's warblers. Prairie falcons nesting in Fern Canyon frequently perch on The Slab.

Management: Off trail hikers and dogs at large often pass through the bracken fern and raspberry thickets at the base of The Slab. A social trail cuts through the bracken ferns and follows the base of The Slab for a quarter of a mile. Staff may wish to restrict access to this area, which is rich in biological resources.

General Management Considerations

Because the Flatirons support a diverse array of birds and mammals and receive intensive recreational use, staff must constantly balance the wishes of recreational users with the needs of wildlife. To date, few restrictions have been placed on recreational use. As recreational use

increases, staff may need to use a variety of tools, including area closures, trail closures, and restrictions on off trail hiking, to protect wildlife.

Cliff-nesting Raptors

Since 1983, Mountain Park staff and volunteers have documented productivity of cliff-nesting raptors within the Park. A single pair of golden eagles and two to four pairs of falcons have nested in the Park each year. Seasonal area closures have been instituted to protect nesting raptors.

Although the number of nesting pairs of eagles and falcons remained relatively constant from 1983-96, nesting failures appear to have increased in recent years. In 1995 all four nests observed within the Park (two peregrine falcon, one prairie falcon, and one golden eagle) failed to fledge young. These failures may have been caused in part by unusually heavy spring rains, which flooded some eyries, and a plague outbreak that decimated prairie dog populations on the plains. In 1996 two peregrine falcon nests fledged a total of two young, one prairie falcon nest fledged three young, and the golden eagle nest fledged one young. However, the peregrine nest on the Third Flatiron failed again, and two additional prairie falcon nesting attempts failed on Dinosaur Mountain and in Shadow Canyon (Steve Armstead, pers. commun.). Raptor nesting area closures appear to have been partially successful. During the 1995-96 nesting seasons, most recreational users honored these closures, but staff noted several instances of climbers disturbing active nests. The Third Flatiron peregrine falcon nest was disturbed on at least two occasions (Steve Armstead, pers. commun.).

I recommend that staff continue to post closures of all potential cliff-nesting raptor sites, beginning in mid-February and extending through mid-July. Areas that should be closed to

recreational use during this nesting period include, but are not limited to, the Third Flatiron, the Back Porch area of Dinosaur Mountain, Bear Canyon west of the Mesa Trail, nesting cliffs in Fern Canyon, and nesting cliffs in Shadow Canyon. In addition, I recommend that staff expand the raptor nest monitoring program. Ideally, volunteers should be posted near all active nests during weekend daylight hours, April - July. Nesting prairie falcons are becoming rare in Boulder County. Between 1991-96, peregrine falcons supplanted prairie falcons from historic nest sites on Eldorado Mountain, in Shadow Canyon, on the Third Flatiron, and on Steamboat Mountain, northwest of Lyons. Staff may wish to institute a long-term research program to study ways to enhance nesting opportunities for prairie falcons.

Cavity-nesting Birds

The density of cavity-nesting birds on twelve 5-ha plots within the Flatirons ranged from 0-25% of the total breeding bird population (Table 3). In Rocky Mountain old-growth coniferous forests, cavity-nesters typically comprise about 30-50% of the total breeding bird population (Scott et al 1980). A scarcity of snags in some areas of the Flatirons probably limits cavity-nesting opportunities. Existing snags should be protected. When constructing new trails, staff may wish to map existing snags and route trails away from them.

Ground and Shrub-nesting Birds

Some areas of the Mountain Park support high densities of ground and shrub-nesting birds. Off trail hikers and dogs at large can disturb ground and shrub-nesting birds, contributing to nest failure. Miller and Knight (1996) found that songbird nesting success decreased dramatically within 100 m of hiking trails on City of Boulder open space. They theorized that

disturbance by hikers, predation by corvids and other "human associate" species, and "edge effect," created by trail construction, may all contribute to songbird nest failures along trail corridors. During earlier breeding bird studies, I sampled two 5-ha plots in NCAR Meadow and Chautauqua Meadow, which are heavily used by recreationists and their pets (Jones 1990, 1993). These plots supported no nesting sparrows and only two species of nesting birds: western meadowlark and european starling.

Staff may wish to institute a variety of restrictions on recreational use to protect ground and shrub-nesting birds. These restrictions can include seasonal trail closures, leash requirements for dogs and other pets, and signs advising hikers and their pets to stay on trail. Areas of the Mountain Park where restrictions of this type should be considered include Long Canyon, Greenman Spring, Bluebell Canyon (including McClintock and Royal Arch trails), Skunk Canyon (from Deer Valley Road trailhead to above the narrows), and Bear Canyon west of the Mesa Trail. I recommend that staff experiment with seasonal closures or restrictions and encourage further research on impacts of recreational use on ground and shrub-nesting birds.

Black Bears and Mountain Lions

Sightings of black bears and mountain lions have increased within the Park within recent years. This increase may reflect an expansion of black bear and mountain lion populations, an increase in recreational use, or both. Staff has instituted voluntary area closures to protect foraging black bears. These closures appear to have reduced recreational use in areas where foraging bears are frequently sighted. I recommend that staff continue to post voluntary closures of black bear foraging areas. Dogs should be restricted from these areas.

RECOMMENDATIONS FOR ADDITIONAL RESEARCH

Breeding bird population data from this study can provide baseline information that can be field checked at five to ten year intervals to see how breeding bird populations are changing within the Mountain Park. Additional research should focus on gathering information about mammal populations and closely monitoring interactions between recreational users and wildlife populations. The following research efforts would be particularly beneficial:

1. Live trapping of small mammals.
2. Radio collaring of black bears to determine migration routes and hibernation sites.
3. ~~Continued mist-netting of bats and searching for additional roost sites and hibernacula.~~
4. Monitoring of accipiter populations and searching for nest sites.
5. Continued monitoring of cliff-nesting raptor populations.
6. Studying effects of recreation on ground and shrub-nesting birds along trail corridors.
7. Experimenting with seasonal closures of drainages and/or trail corridors and studying the effects on wildlife populations.
8. Continued mapping of nest locations for county, state, and federal birds species of special concern within the park.

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APPENDIX: TRANSECT LOCATIONS AND DESCRIPTIONS**First Flatiron and Contact Canyon**

Start: Junction of Gregory Canyon and Saddle Rock trails.

Finish: Base of First Flatiron.

Directions: Follow Saddle Rock Trail and then First Flatiron Trail.

First/Second Flatiron

Start: Junction First/Second Flatiron trails.

Finish: Saddle between First and Second Flatirons.

Directions: Follow trail between First and Second Flatirons.

Second/Third Flatirons

Start: Junction of Second and Third Flatirons trails.

Finish: Point due north of Second Ironing Board summit.

Directions: Follow main trail up canyon bottom.

Bluebell Canyon

Start: Where Royal Arch trail crosses Bluebell Creek.

Finish: Point due south of Second Ironing Board summit.

Directions: Follow Royal Arch trail to seventh switchback, and then follow climber's trail up north side of canyon.

Tangen Spring

Start: Wood's Quarry.

Finish: Royal Arch.

Directions: Follow social trail from Wood's Quarry to Royal Arch trail, and then follow Royal Arch trail to base of Royal Arch.

Royal Arch

Start: Where old wagon road branches off from Mesa Trail.

Finish: Point due south of Royal Arch.

Directions: Follow wagon road, and then follow climber's trail.

Skunk Canyon

Start: Where Mesa Trail crosses Skunk Creek.

Finish: 50 m west of narrows.

Directions: Follow climber's trail.

Dinosaur Mountain

Start: 75 m south of Mesa Trail/Mallory Cave Trail.

Finish: Base of Back Porch rock formation.

Directions: Follow climber's trail from Mallory Cave Trail to base of Back Porch rock formation.

Bear Canyon

Start: Power station.

Finish: Second creek crossing.

Directions: Follow Bear Canyon Trail.

Fern Canyon

Start: Fern Canyon/Shanahan Ridge Trail Junction.

Finish: Top of saddle.

Directions: Follow Fern Canyon Trail.

Shadow Canyon

Start: Spring above second cabin.

Finish: 500 m up canyon.

Directions: Follow Shadow Canyon Trail.

Bear Peak Slab

Start: Base of Slab at Shanahan Ridge Trail.

Finish: Cave where canyon cuts through Slab.

Directions: Follow Social Trail up base of Slab.
