

Ecology, Status and Avifauna of Willow Carrs

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Study



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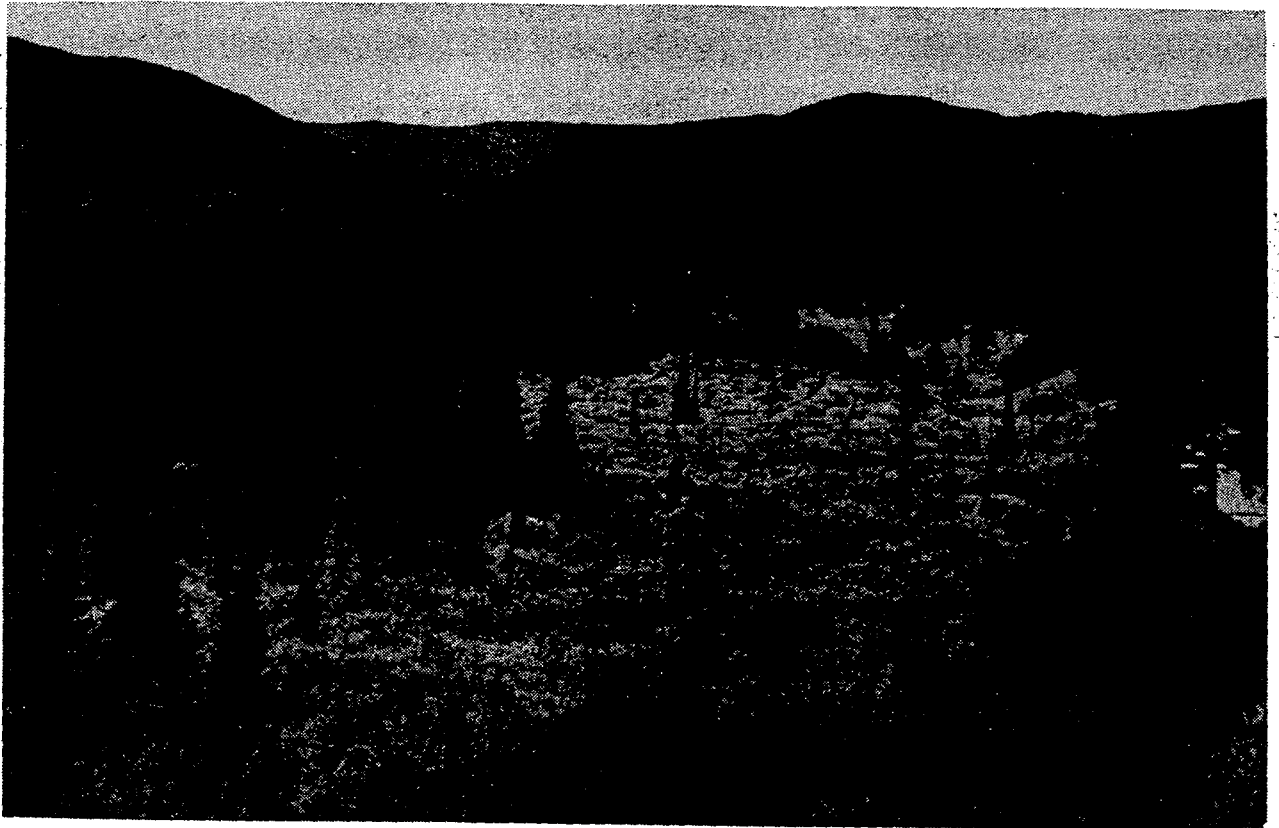
**Ecology, Status and Avifauna of Willow Carrs  
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ECOLOGY, STATUS AND AVIFAUNA  
OF  
WILLOW CARRS  
IN  
BOULDER COUNTY

Dave Hallock, Nancy Lederer, and Mike Figgs



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ECOLOGY, STATUS AND AVIFAUNA  
OF WILLOW CARRS  
IN BOULDER COUNTY

INTRODUCTION

The major wetland type from 8,000 feet to above treeline in Boulder County is the willow carr - willow (Salix spp.) dominated plant associations that have a flowing water system. The distribution of willow carrs in the county has not been previously documented. Several vegetation studies have described the willow carrs most likely to be encountered on the east slope of the Front Range (Baker 1983, 1984, Heifner 1974, Hess 1981, Phillips 1977, USDA Forest Service 1983). Few data are available on breeding bird species and populations in willow carrs (Cody 1974). Objectives of this study were to: (1) describe vegetative and ecological parameters of willow carrs; (2) document the current distributional status of willow carrs, including threats to their continued existence; (3) ascertain some measure of the importance of willow carrs to avifauna through studies of breeding birds and winter populations of White-tailed Ptarmigan; and (4) investigate some of the changes that occur in the ecology and avifauna relative to elevation change.

METHODS

Four willow carrs were selected for vegetation analysis. They were: Copeland Carr (8,320 feet elevation); Tucker Carr (8,480 feet); Brainard Lake Carr (10,280 feet); and Bunker Hill Carr (11,100 - 11,400 feet).<sup>1</sup> In each carr, six 50 meter line transects were established in order to describe percentage of ground cover by floral species. Additionally, along the same transects at 1 or 5 meter intervals, heights of closest shrubs were measured. Vegetation data are summarized in Appendix IV.

Using U.S. Fish and Wildlife Service Wetland Inventory Maps as a base, identified carrs (those having a shrub-scrub/emergent vegetation symbol) were field checked. Field surveys were conducted in 1983, 1984 and 1985. Each area was investigated in summer and 62% of the carrs were also visited in winter. Summer investigations were conducted to compare, and amend as necessary, the size and location of carrs on the wetland inventory maps. Additionally, summer observers noted presence of current or historical beaver activity (beaver sightings, tracks, lodges, dams, ponds or vegetative cuttings) and indications of domestic grazing by horses, cows or sheep (sightings and/or tracks and droppings). Other threats to the continued existence of willow carrs (reservoirs, development, peat extraction and road construction) were identified through discussion with personnel of the Boulder County Land Use Department. Winter field investigators recorded all observations of White-tailed Ptarmigan and/or sign (tracks, roosts and droppings).

Breeding birds were censused by the territory mapping method (Williams 1936) as standardized by the International Bird Census Committee (1970). Four locations were censused: (1) Copeland Carr in 1983 and 1984; (2) Tucker Carr in 1983 and 1984; (3) Brainard Lake Carr in 1983 and 1985; and (4) Bunker Hill Carr in 1984 and 1985. Censuses were conducted from mid-May until the end of July with 8 - 10 trips conducted in each study area during the breeding season.

<sup>1</sup>For respective locations on maps in Appendix II, see area no. 7 on the Allens Park map, area no. 6 on the Nederland map, area no. 6 on the Ward map, and area no. 10 on the Nederland map.

Fifteen additional willow carrs were surveyed during the breeding season in 1983 and 1984 for bird species composition. The sites ranged in elevation from 8,400 to 12,000 feet as 5 montane, 8 subalpine and 2 alpine locations were investigated. Researchers randomly walked each site for a minimum of 1 hour recording nesting and territorial species. A minimum of two surveys was made at each site.

## RESULTS AND DISCUSSION

### Description of Willow Carrs

The lower elevational limit of major willow carrs in Boulder County appears to be the eastern extent of Pleistocene glaciers. The flat U-shaped valleys provide good habitat for beaver who dam the streams, raise the water table and increase the cover of wetland shrubs, grasses and sedges (Hall 1960). Below 8,000 feet the mountain riparian systems are poorly developed, being restricted to the narrow streambanks in steep canyons (such as Boulder Canyon between Boulder and Nederland) until the plains are reached.

The plant associations of willow carrs are dominated by one or several species of willow, reedgrass (Calamagrostis spp.), birch (Betula spp.), and sedge (Carex spp.) (Appendix IV). Elevation, soil type, and amount of soil moisture are among the factors determining which species occur at a given site. The montane carrs studied, Copeland and Tucker, are examples of the Salix geyeriana - Salix monticola/Calamagrostis canadensis Mesic Carr; the subalpine and alpine carrs studied, Brainard Lake and Bunker Hill respectively, represent the Salix planifolia - Betula glandulosa - Salix spp./Carex aquatilis - Carex rostrata Wet Carr (Baker 1984, Hess 1981, Phillips 1977, USDA Forest Service 1983).

In general, shrub height decreases with increased elevation (Table 1). Additionally, montane willow carrs (between 8,000 and 9,000 feet) have greater surface area of ponded water and more active beaver colonies than the subalpine and alpine areas. Soil types also differ, as montane carrs have mineral soils while those in the subalpine have substantial accumulations of peat. Montane carrs, being farther downstream and downhill, are subjected to greater stream scouring that prevents buildups of peat (Phillips 1977).

Figures 1 through 3 are photographs of the montane, subalpine, and alpine carrs in which the vegetation and breeding bird studies were conducted. The cover photo is of Tucker Carr, a montane carr along Caribou Road west of Nederland.

### Status of Willow Carrs in Boulder County

There are 2092 total acres of willow carr remaining in Boulder County, of which 24% are located in the montane lifezone, 57% in the subalpine and 19% on the tundra. Willow carrs comprise approximately 1% of the lands in Boulder County above 8,000 feet (Table 2). Appendix I summarizes characteristics of field-checked carrs, Appendix II consists of National Wetland Inventory maps showing the locations of the carrs, and Appendix III presents data on numbers and sizes of carrs.

Their locations, being glaciated stream valleys, have made them vulnerable as flat land and flowing water have also attracted human activities. At least 19% of the montane and subalpine carrs have been lost to housing developments, grazing pasture, peat extraction and reservoirs (Fig. 4). It is probable that other sites were once carrs.

Montane carrs, due to their proximity to human development, are the most threatened of the three lifezones as most subalpine and alpine carrs are within

Table 1. Some ecological parameters of Boulder County willow carrs.

	Montane	Subalpine	Alpine
Average shrub height (meters)	2.66	1.00	.75
Willow carr acreage containing current or past presence of beaver	292	527	0
% of carrs containing current or past presence of beaver	59%	44%	0%

Table 2. Current status of willow carrs in Boulder County.

	Montane	Subalpine	Alpine	Total
Acres remaining	497	1189	406	2092
Acres lost	104	281	0	385
% of carr acreage affected by grazing and/or threatened by development	71%	20%	10%	30%

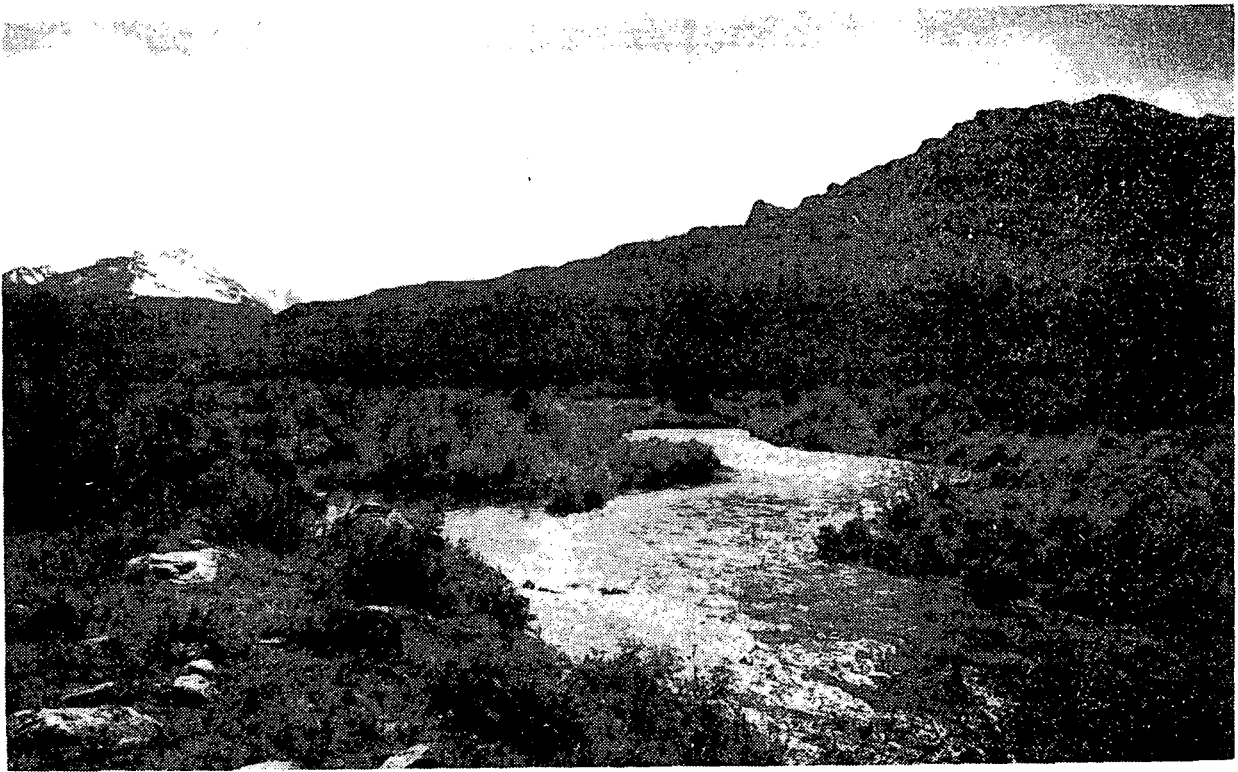


Figure 1. The North St. Vrain Creek flows through Copeland Carr, a montane willow carr located at the Wild Basin entrance to Rocky Mountain National Park. (Another montane carr, Tucker Carr in Nederland, is pictured on the front cover.)



Figure 2. Brainard Lake Carr, a subalpine willow carr east of Brainard Lake in the Indian Peaks. Shrub height is much lower here than in the montane carrs, and breeding bird density and number of species are also lower.



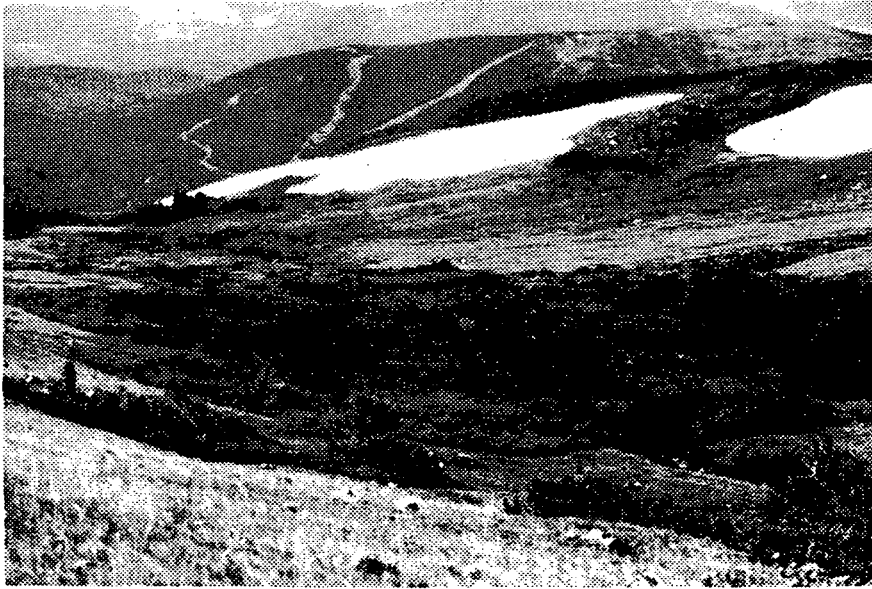


Figure 3. Bunker Hill Carr lies above the North Fork of Middle Boulder Creek and is an example of an alpine willow carr. This site is important breeding and winter habitat for White-tailed Ptarmigan.

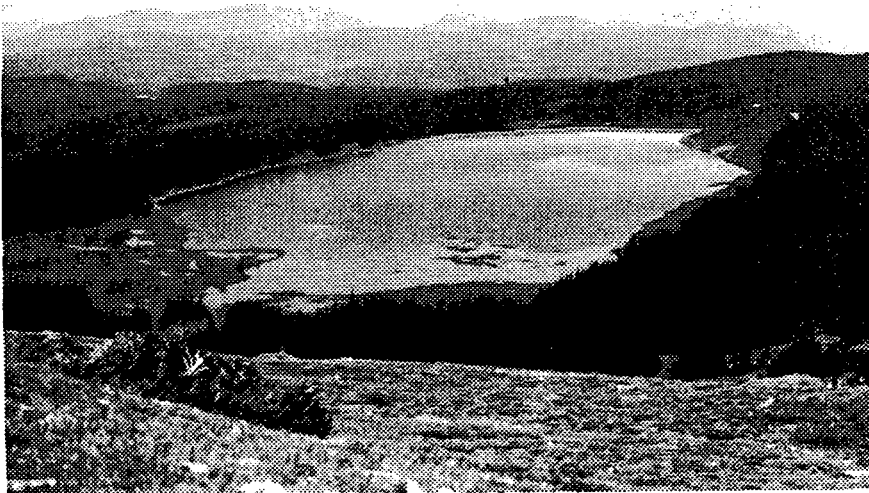


Figure 4. Lefthand Reservoir, one mile southeast of Brainard Lake. Construction of this reservoir destroyed approximately 75 acres of subalpine willow carr. Photo taken from Niwot Ridge.



the Indian Peaks Wilderness Area or Rocky Mountain National Park. The greatest threats to montane carrs are housing development, reservoirs, and grazing of domestic animals. Field observations suggest that the result of long-term over-grazing in the carrs is the destruction of the willows and disturbance of the native grasses leading to invasion of exotics such as timothy (Phleum pratense). Willows decrease in cover while timothy, other grasses and shrubby cinquefoil (Pentaphylloides floribunda) increase. Hess (1931) and Phillips (1977) describe invasion of Kentucky bluegrass (Poa pratensis), dandelion (Taraxacum officinale) and other weedy species in response to grazing.

Only 29% of the montane willow carrs in Boulder County are not threatened by domestic animal grazing and development. The largest non-threatened montane carr is located near Peaceful Valley (18 acres, see area no. 1 on the Allens Park map). The largest montane carr in the county is Copeland Carr (77 acres). See Appendix V for further details concerning this site.

The largest subalpine carrs in the county are Coney Creek (72 acres, area no. 3 on the Allens Park map) and Brainard Lake (60 acres).

The county's largest alpine carrs are Coney Lake (75 acres, area no. 8 on the Ward map), Bunker Hill (20 acres), and King Lake (19 acres, area no. 3 on the East Portal map).<sup>1</sup>

Tables 3 and 4 present information on the number and sizes of willow carrs in Boulder County. The majority of carrs (79%) are less than 5 acres in size yet they comprise only 31% of the total acreage. Only 11% of the carrs are greater than 10 acres in size, yet they make up 55% of the total acreage.

#### Importance of Willow Carrs to Avifauna, and Elevation Differences

The censuses indicated that willow carrs have relatively high densities of breeding birds (Table 5). Montane carrs averaged 640 pairs/100 acres compared to a range of 91 - 270 pairs/100 acres in various montane forest habitats. The subalpine carr censuses averaged 286 pairs/100 acres, compared to 94 and 131 pairs/100 acres in two subalpine forest censuses. Overall density and species diversity decreased with increasing elevation (Table 6).

Wilson's Warbler and Lincoln's Sparrow were the most common breeding species in the montane and subalpine willow carrs and were present in the alpine carrs. Other species, such as Song Sparrows, Yellow Warblers and Black-headed Grosbeaks, appear to reach an elevational maximum in the montane carrs. White-crowned Sparrows were rarely found in montane carrs as their presence began at about 8,700 feet and increased in density with increased elevation. It was the most common breeder in alpine willow carrs. In most carrs, scattered coniferous trees were present and species such as Mountain Chickadees, Ruby-crowned Kinglets, Yellow-rumped Warblers and Pine Siskins were occasionally found breeding.

There were several interesting finds. One is the substantiation of Fox Sparrows as fairly common breeders in mountain riparian ecosystems of Boulder County. They had been listed as winter visitors in latilong 4 and the level of abundance was "unusual" (Chase et al. 1982). In Boulder County, the Fox Sparrow is restricted in breeding distribution to montane and subalpine willow carrs. Additionally, Ring-necked Ducks were found breeding at two locations in the county. Both sites have a willow carr adjacent to a fairly large (10 - 30 acres) body of water. Finally, a singing male Tennessee Warbler (Vermivora peregrina) and a singing male Canada Warbler (Wilsonia canadensis) were found on the ecotones between a willow carr and forest. Both sightings were in a spruce (Picea spp./alder (Alnus tenuifolia) plant community.

<sup>1</sup>Coney Lake Carr, as well as several other alpine and subalpine carrs, is a mosaic of willows and conifers.

Table 3. Size distribution of willow carrs in Boulder County.

<u>Size (acres)</u>	<u>Number</u>	<u>% of carrs in size category</u>
0 - 5	321	79%
6 - 10	41	10%
11 - 20	30	7%
21 - 30	7	2%
31 - 50	4	1%
50 - 100	5	1%
Total	408	100%

Table 4. Acreage of willow carrs in Boulder County relative to size category.

<u>Size (acres)</u>	<u># of acres in size category</u>	<u>% of total acreage</u>
0 - 5	642	31%
6 - 10	308	14%
11 - 20	474	23%
21 - 30	181	9%
31 - 50	148	7%
51 - 100	339	16%
Total	2092	100%

Table 5. Comparison of willow carr breeding bird densities and number of breeding species with other mountain habitats.

Habitat type	# of breeding species	Density (pairs/100 acres)	Reference
Montane lifezone			
1. Montane willow carr	22	640	Figgs, 1984, 1985; Hallock, 1984, 1985; this study
2. Ponderosa pine forest	13	270	Hering, 1973
3. Ponderosa pine - Douglas fir forest	15	252	Van Horn, 1984
4. Lodgepole pine forest	13	59	Snyder, 1950
5. Lodgepole pine - aspen forest	15	91	Kingery, 1971
6. Aspen grove with scattered conifers	29	184	Alles, 1984
Subalpine lifezone			
1. Subalpine willow carr	13	286	Lederer, 1984; this study
2. Spruce - fir forest	12	94	Snyder, 1950
3. Pine - spruce - fir forest	14	131	Archie and Hudson, 1973
Alpine lifezone			
1. Alpine willow carr, krummholz and meadow	6	109	Hallock, 1985b; this study

Table 6. Breeding bird species and density in 8 censuses of willow carrs  
in Boulder County.

Species	Density/100 acres <sup>a/</sup>		
	Montane	Subalpine	Alpine
Green-winged Teal ( <u>Anas crecca</u> )	9	b/	
Mallard ( <u>Anas platyrhynchos</u> )	11	2	
Ring-necked Duck ( <u>Aythya collaris</u> )	b/		
White-tailed Ptarmigan ( <u>Lagopus leucurus</u> )			+ <sup>c/</sup>
Sora ( <u>Porzana carolina</u> )		b/	
Killdeer ( <u>Charadrius vociferus</u> )		b/	
Spotted Sandpiper ( <u>Actitis macularia</u> )	5	b/	
Common Snipe ( <u>Gallinago gallinago</u> )	10	6	
Broad-tailed Hummingbird ( <u>Selasphorus platycercus</u> )	44	b/	
Belted Kingfisher ( <u>Ceryle alcyon</u> )	+		
Yellow-bellied Sapsucker ( <u>Sphyrapicus varius</u> )	+	b/	
Dusky Flycatcher ( <u>Empidonax oberholseri</u> )	50	13	6
Black-capped Chickadee ( <u>Parus atricapillus</u> )	+		
Mountain Chickadee ( <u>Parus gambeli</u> )		4	
House Wren ( <u>Troglodytes aedon</u> )	+		
Ruby-crowned Kinglet ( <u>Regulus calendula</u> )	+	4	
Swainson's Thrush ( <u>Catharus ustulatus</u> )	23	+	
American Robin ( <u>Turdus migratorius</u> )	51	6	+
Water Pipit ( <u>Anthus spinoletta</u> )			+
Warbling Vireo ( <u>Vireo gilvus</u> )	34	2	
Orange-crowned Warbler ( <u>Vermivora celata</u> )	+		

Table 6. (continued)

Species	Density/100 acres		
	Montane	Subalpine	Alpine
Yellow Warbler ( <u>Dendroica petechia</u> )	15		
Yellow-rumped Warbler ( <u>Dendroica coronata</u> )		8	
MacGillivray's Warbler ( <u>Oporornis tolmiei</u> )	28	b/	
Wilson's Warbler ( <u>Wilsonia pusilla</u> )	132	104	22
Black-headed Grosbeak ( <u>Pheucticus melanocephalus</u> )	12		
Green-tailed Towhee ( <u>Pipilo chlorurus</u> )	+		
Fox Sparrow ( <u>Passerella iliaca</u> )	24	7	
Song Sparrow ( <u>Melospiza melodia</u> )	67		
Lincoln's Sparrow ( <u>Melospiza lincolni</u> )	90	89	28
White-crowned Sparrow ( <u>Zonotrichia leucophrys</u> )	b/	35	53
Dark-eyed Junco ( <u>Junco hyemalis</u> )	3	6	
Red-winged Blackbird ( <u>Agelaius phoeniceus</u> )	27	2	
Brown-headed Cowbird ( <u>Molothrus ater</u> )	5	2	
Pine Siskin ( <u>Carduelis pinus</u> )	+	4	
Total Density	640	286	109
Total Number of Species <sup>d/</sup>	21	13	7

a/ Territorial males or females.

b/ In less detailed surveys of carrs, were found to be either nesting or present during breeding season and are suspected nester.

c/ + = less than 0.5 territories in census plot.

d/ Average of actual breeding bird censuses.

Surveys revealed that indication of current or past beaver activity decreased with increasing elevation (see Table 1). Species associated with beaver ponds such as Mallard, Green-winged Teal and Spotted Sandpiper were more common in montane carrs, adding to their species diversity and density.

In Boulder County, the breeding species that appear to be the most dependent on willow carrs are the Ring-necked Duck, Dusky Flycatcher, Swainson's Thrush, Wilson's Warbler, Fox Sparrow, Lincoln's Sparrow and White-crowned Sparrow.

None of the montane carrs showed signs of White-tailed Ptarmigan, while in 32% of the surveyed subalpine carrs and 43% of the alpine carrs their signs were present, indicating the importance of these high altitude habitats. Studies of the White-tailed Ptarmigan in Colorado (Braun et al. 1976) have shown that during winter this species is heavily dependent on subalpine and alpine willow carrs as willow is its chief winter food.

#### SUMMARY

Willow carrs are important avian habitats comprising about 1% of the mountain landscape in Boulder County. They have relatively high breeding bird densities. Montane carrs have the greatest number of breeding species and highest breeding bird density. Species diversity and density decrease with increasing elevation. Fox Sparrows are totally restricted to willow carrs for breeding habitat while White-tailed Ptarmigan find them important wintering localities. Other animals to which this habitat type is important are beaver, Ring-necked Duck, Dusky Flycatcher, Swainson's Thrush, Wilson's Warbler, Lincoln's Sparrow, and White-crowned Sparrow. Montane carrs are the most threatened due to development and domestic animal grazing.

#### ACKNOWLEDGEMENTS

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## APPENDIX I

The following tables present information on the status of willow carrs in Boulder County. They are organized by USGS Quadrangle Maps which follow in Appendix II. Additionally, within each map, the carrs have been grouped for easier identification.

Explanation of symbols on tables:

Type: M = Montane; S = Subalpine; A = Alpine

Field Checked: S = Summer; W = Winter

Existing Acres: Listed are the sizes of each willow carr and the total for the geographic area outlined on the corresponding map.

USGS Map ALLENS PARK

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	Peaceful Valley	M	8,600'- 8,800'	S/W	4,18 = 22		18			4-wheel drive road on edge of both areas.
2	Middle St. Vrain	S	9,000'- 9,800'	S/W	6,6,4,2,1,1,1, 1,1 = 23		6	14		4-wheel drive road through area.
3	Coney Creek	S	9,700'- 10,900'	S/	72,25,18,7,7, 5,3,2,2,2,1,1, 1,1 = 146		72			4-wheel drive road through area.
4	Rock Creek	S	9,000'- 11,000'	S/	9,2 = 11					
5	Pear Reservoir	S	9,000'- 10,600'	S/	18,7,6,4,4,3, 2,1,1,1 = 47					
6	Sandbeach Lake	S	10,400'- 11,000'	S/	18,13,3,3,2,1, 1,1,1 = 43					
7	Wild Basin	M	8,300'	S/W	77,9,1,1,1 = 89		77	86		Potential of aquifer reservoir.
8	Allens Park	M	8,000'- 8,600'	S/	11,9,8,5,5,4, 3,1,1,1 = 49	4	20	28		Loss from roads and pasture development.
9	Meeker Park	M	8,200'- 8,700'	S/	7,5,5,5,5,4,4, 1,1,1 = 38	40	5	38		Loss from road and pasture development.

USGS Map EAST PORTAL

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	Jenny Lake	S	10,800'- 11,000'	S/W	5,3,2,1,1 = 12				5	Impacts from off-road vehicles.
2	Woodland Flats	S	9,600'- 11,000'	S/W	18,6,6,5,5,4, 3,2,2,2,2,2,2, 2,2,1,1,1,1,1, 1,1 = 74		18		18	
3	Upper King & Woodland Lakes	A	11,000'- 12,000'	S/W	19,4,3,2,2,2, 1,1,1,1,1,1,1, 1,1,1 = 42				23	
4	N. Fork & Chittenden	S	10,000'- 11,200'	S/W	33,5,5,3,2,2, 2,1,1,1 = 55		33		43	
5	Upper Diamond & Devil's Thumb	A	11,000'- 12,000'	S/W	5,4,4,3,3,2,2, 2,2,2,2,1,1,1, 1,1,1 = 37				13	

USGS Map GOLD HILL

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	Pennsylvania Gulch	M	8,000'- 9,000'	S/	3,3,2,2 = 10			8		
2	Camp Tahosa	M	8,000'- 9,000'	S/W	13,9,8,7,7,6, 4,2,1,1,1,1,1, = 61	8	13			

USGS Map ISOLATION PEAK

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	St. Vrain Glacier	A	10,600'-11,600'	S/	4,4,2,2,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1 = 26					
2	Bluebird Lake	A	10,400'-11,100'	S/W	3,2,1,1,1,1,1,1,1,1 = 12				5	
3	Thunder Lake	S	10,000'-11,000'	S/	2,2,2,1,1,1,1,1,1,1,1,1,1,1,1,1 = 21					
4	Upper Thunder Lake	A	11,000'-12,000'	S/	5,3,2,2,2,2,2,2,1,1,1,1 = 22					

USGS Map LONGS PEAK

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	Roaring Fork	S	9,000'-9,300'	S/	2,2,2,2,1,1,1,1,1,1 = 13					
2	Peak-to-Peak	M	8,800'-9,000'	S/	11,7,6,2,1 = 27		24	9		Housing development potential.

USGS Map MONARCH LAKE

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	Upper N. Fork	A	11,000'-11,800'	S/	18,10,4,4,4,4,3,3,2,2,1,1,1,1,1,1,1 = 55					
2	Upper Boulder Watershed	A	11,200'-12,000'	S/	5,2,1,1,1,1,1 = 11					
3	Upper S. St. Vrain	A	11,200'-12,000'	S/	5,2,1,1 = 9					
4	Upper Coney Creek	A	11,000'	S/	3					

USGS Map NEDERLAND

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	Lake Eldora	S	9,300'	S/W	15,2,1,1,1, = 20	31	18			Ski area development caused loss. Development potential threatens more.
2	Lower N. Fork	S	9,700'	S/W	7,1 = 8		7			
3	Eldora	M	8,600'- 8,900'	S/W	5,2,2,1 = 10		7	1		Road through area.
4	Los Lagos	M	8,600'- 9,000'	S/W	14,4 = 18	6	14	18		Road through area.
5	Arapaho Ranch	M	8,400'	S/W	17,6,5,2 = 30	30	17	30		Gravel extraction caused loss. Potential development and reservoir.
6	Tucker Property	M	8,400'	S/W	19,2 = 21	4	19	21		Peat extraction caused loss. Potential reservoir and development.
7	Caribou Ranch	M	8,400'	S/W	15,14,12,3,3, 1,1,1,1,1,1, = 55	20	41	55		Grazing caused loss. Potential development.
8	Caribou Flats	S	10,000'	S/W	21,18,4 = 43			43	4	
9	Caribou	S	10,000'	S/W	46,34,30,26,5, 2,1,1,1 = 146	32	106	146		Peat extraction caused loss. Threats from peat extraction, reservoir potential and off-road vehicles.
10	Bunker Hill	A	11,100'- 11,600'	S/W	20			20	20	

USGS Map PANORAMA PEAK

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	House Rock	M	8,600'	S/	2					

USGS Map RAYMOND

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	Deer Ridge	M	8,600'	S/	3,3 = 6					
2	M. St. Vrain	M	8,200'- 8,900'	S/	4,3,1,1,1,1 = 11					

USGS Map TUNGSTEN

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	N. Boulder Creek	M	8,000'- 8,500'	S/W	6,4,1,1,1,1 = 14		6	4		Road through area.
2	Tungsten	M	8,000'	S/W	4					
3	Coal Creek	M	8,000'- 8,600'	S/W	9,7,2 = 18		16	15		Road through area.

USGS Map WARD

#	Name	Type	Elevation	Field Checked S/W	Existing Acres	Lost Acres	Presence of Beaver Ponds (Acres)	Presence of Domestic Grazing (Acres)	Presence of Winter Ptarmigan (Acres)	Comments
1	Upper Caribou	A	10,800'- 11,600'	S/W	13,8 = 21			21	21	
2	Rainbow Lakes	S	9,800'- 10,200'	S/	9,8,5,3,3,1,1, 1 = 32					
3	Peak-to-Peak	M	8,800'- 9,000'	S/	7,7,3,3,2,1,1, 1,1 = 26			11		
4	Lower Boulder Watershed	S	9,800'- 10,600'	S/	26,20,18,11,11, 10,7,7,6,5,4,4, 3,2,2,2,1,1 = 146		54			
5	Upper Boulder Watershed	A	11,000'- 11,800'	S/	3,3,2,1 = 9					
6	Brainard Lake	S	9,400'- 11,000'	S/W	60,55,35,30,23, 20,20,18,13,11, 10,8,5,4,3,3,3, 2,2,2,2,1,1,1, 1,1,1 = 336	82	183		165	Loss due to Lefthand Reservoir and roads.
7	Isabelle/ Blue Lakes	A	11,000'- 12,000'	S/W	8,7,7,5,3,3,3, 2,2,2,1,1,1 = 45				15	
8	Coney Lake	A	11,000'	S/	75,7,6,4,2 = 94					
9	Stapp Lakes	S	9,000'- 10,000'	S/	10,3,2,1,1,1,1, 1,1,1,1,1 = 24	136				Loss due to Beaver Reservoir and peat extraction.



## APPENDIX II

The following Wetland Inventory Maps produced by the U. S. Department of Interior (and overlaid upon USGS Quadrangle Maps) have been used as a base for field checking willow carrs in Boulder County. The symbol SS/EM stands for shrub-scrub and emergent vegetation. From approximately 8,000 feet elevation and higher this equates to a willow carr. SS/EM sites lower in elevation are dominated by alder (Alnus tenuifolia) and river birch (Betula fontinalis).

The sites have been field checked and the maps corrected accordingly.

Explanation of symbols on maps:

$\frac{SS}{EM}$ B and  $\frac{SS}{EM}$ C equate to a willow carr (dot pattern has been added);

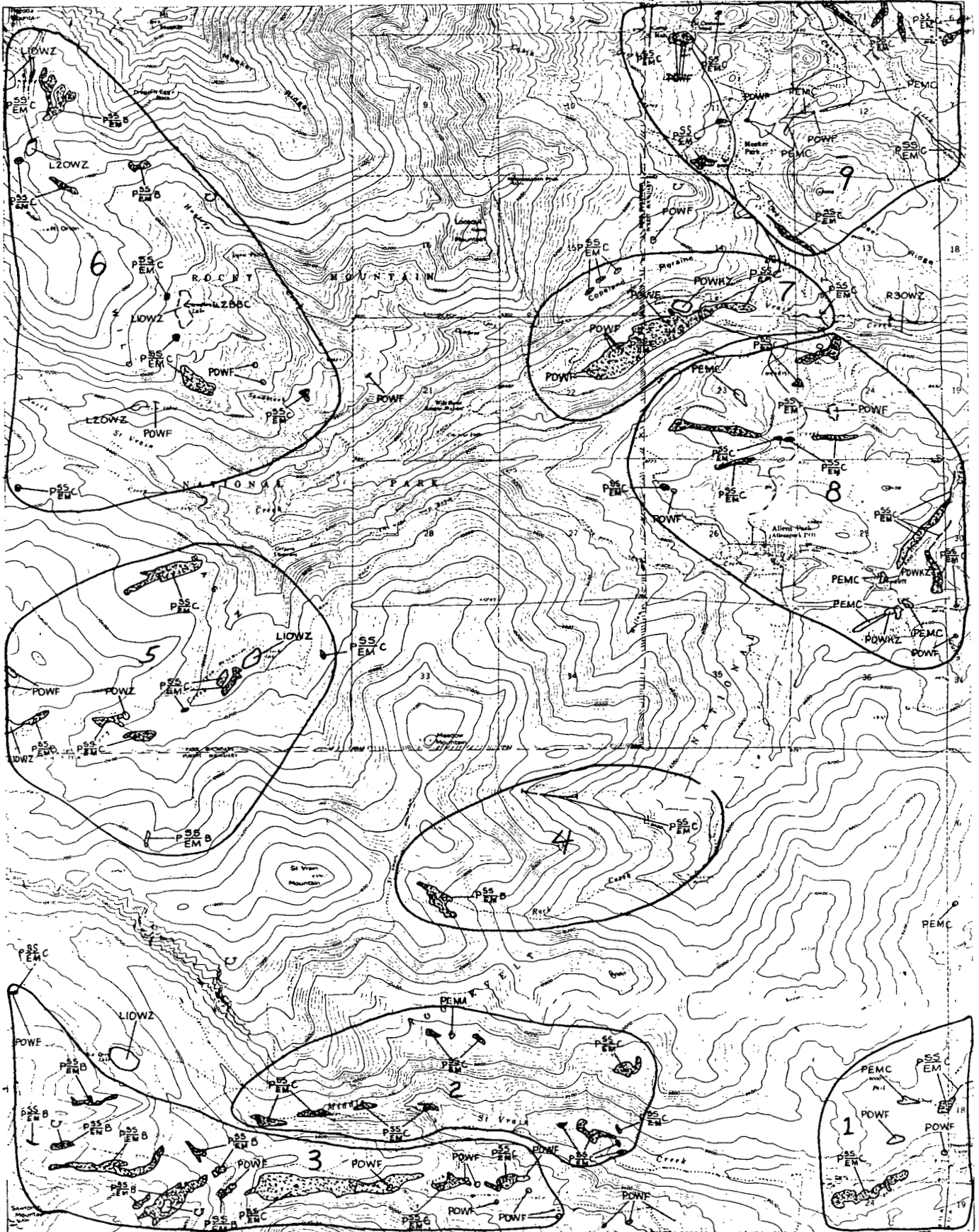
+ = carr acreage from adjacent map has been added;

- = carr acreage not included on this map but added to adjacent map.

NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

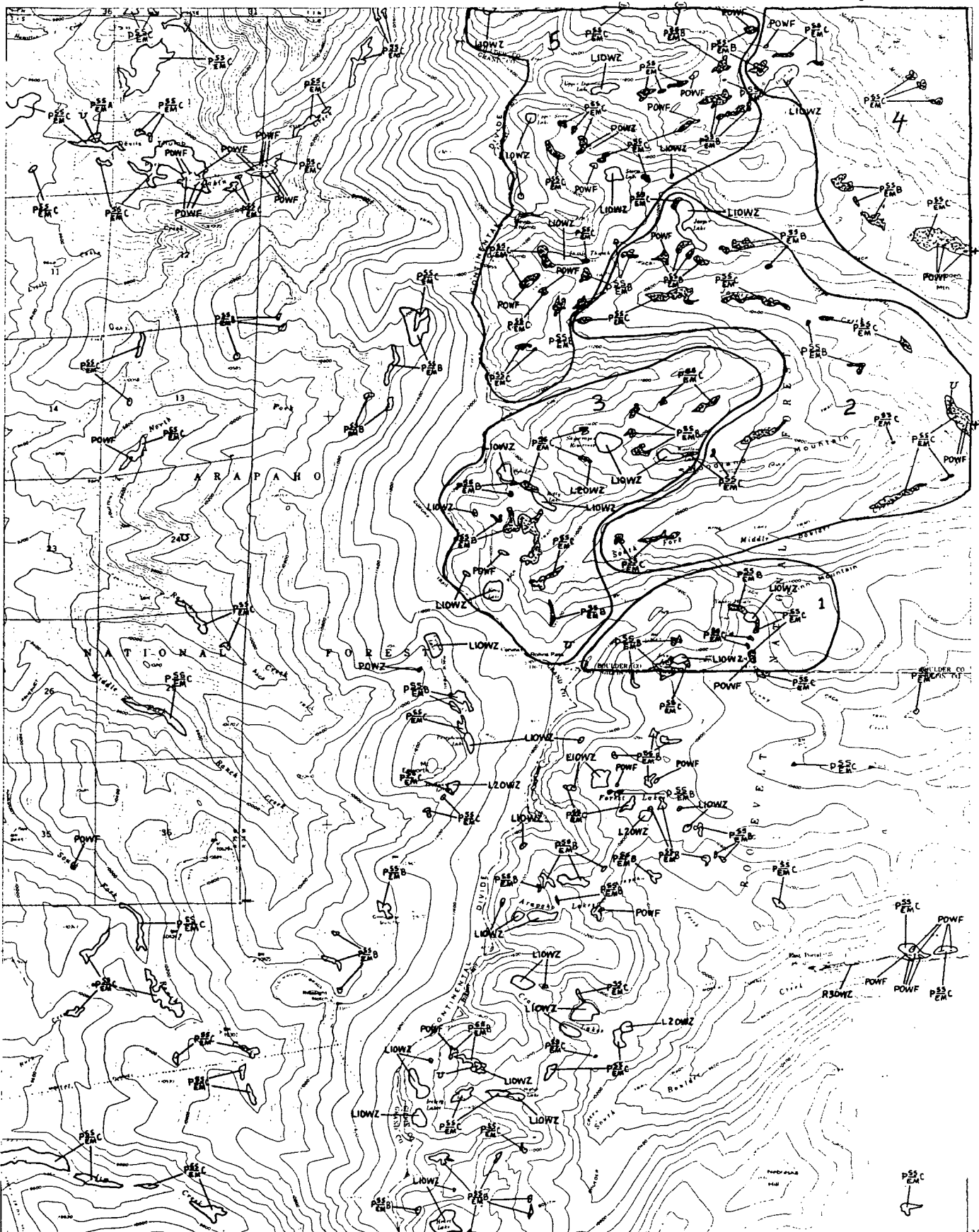
Allens Park

*BR 8*



NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

East Portal



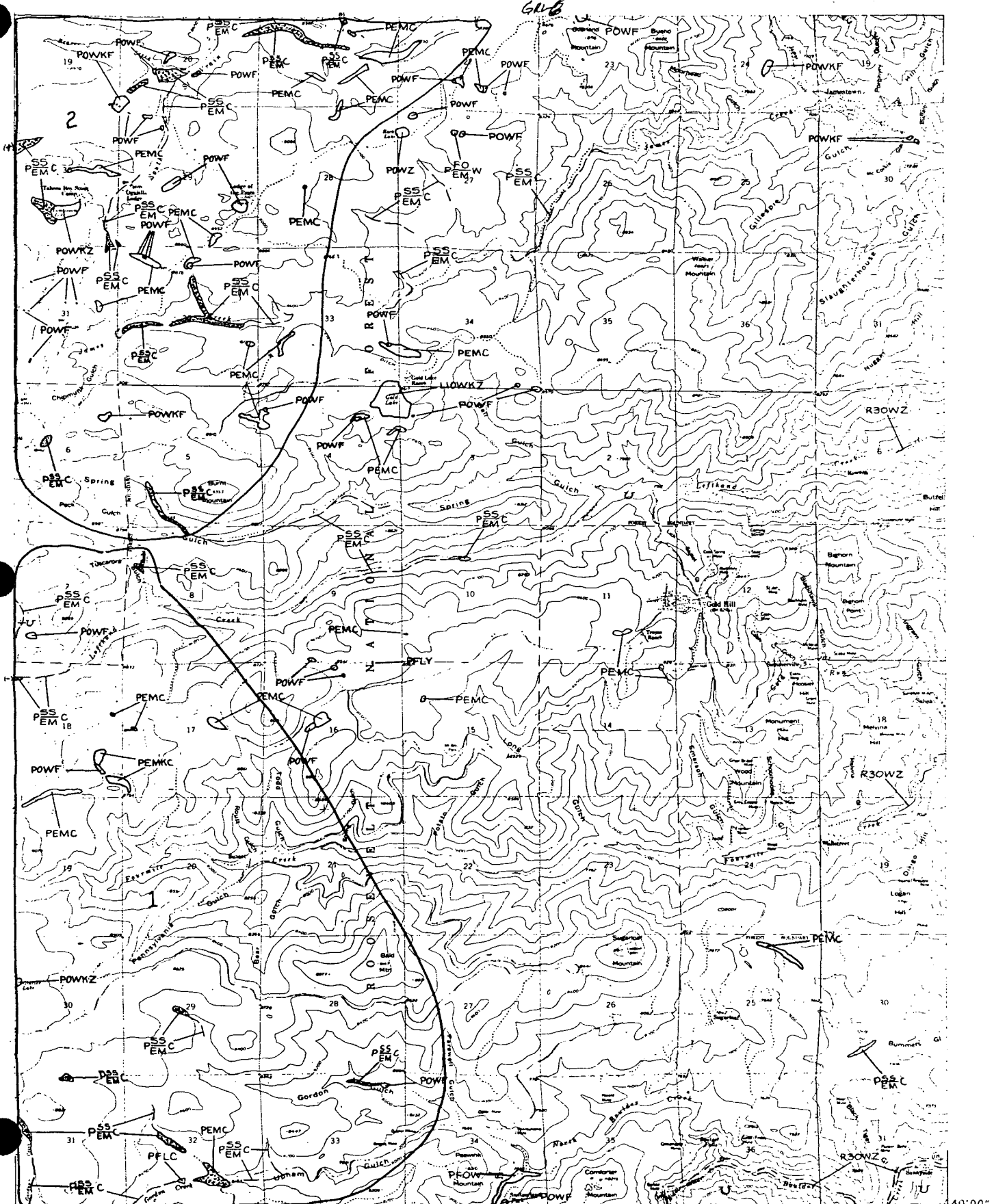
DENVER NW  
DENVER WFST

39°52' 30  
105°37' 30

EAST PORTAL, COLO

NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

Gold Hill



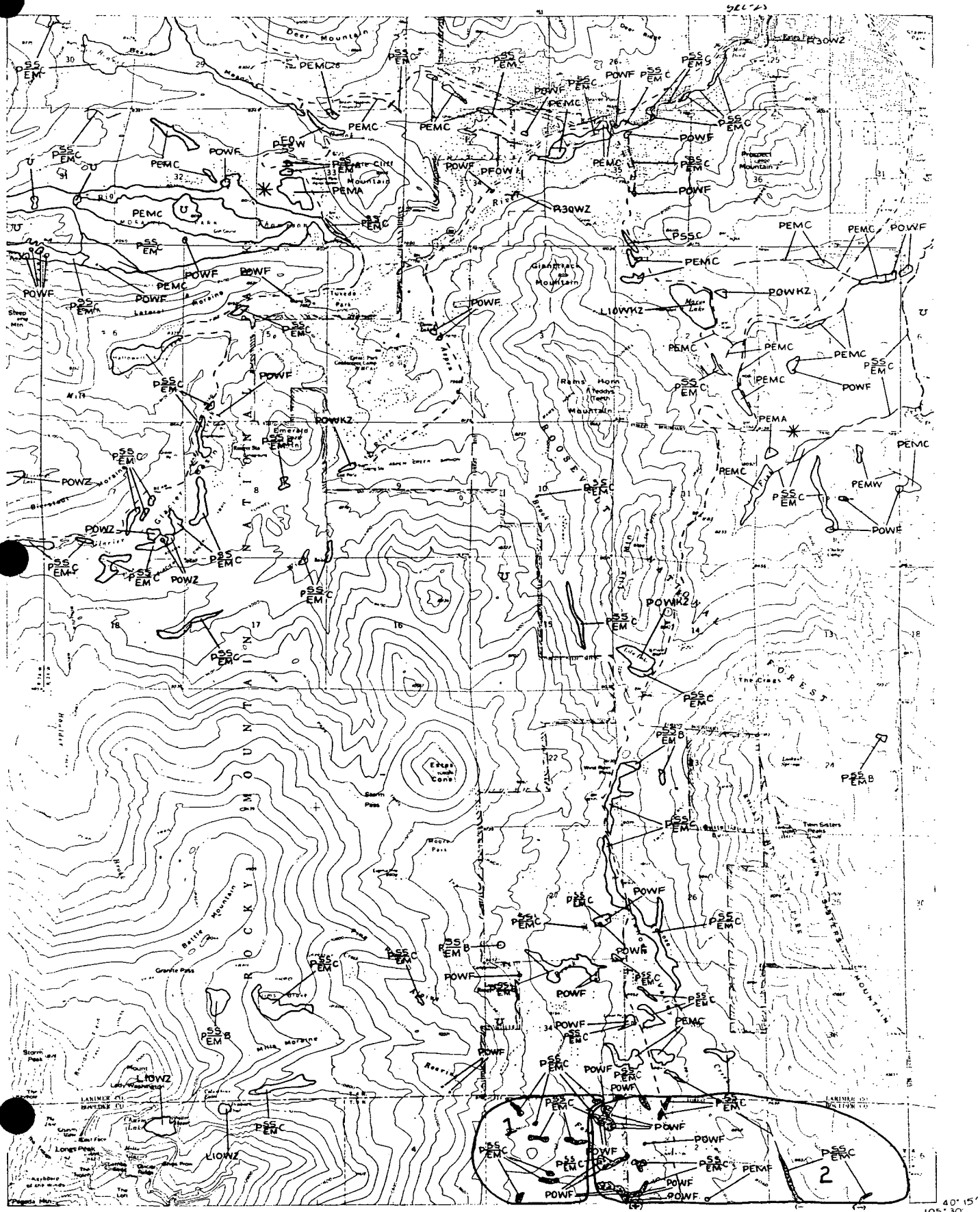
GREELEY SW  
SECTION 36

40'00"  
105'22'30"  
GOLD HILL, COLO.



NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

Longs Peak



GREELEY SW  
ESTES PARK

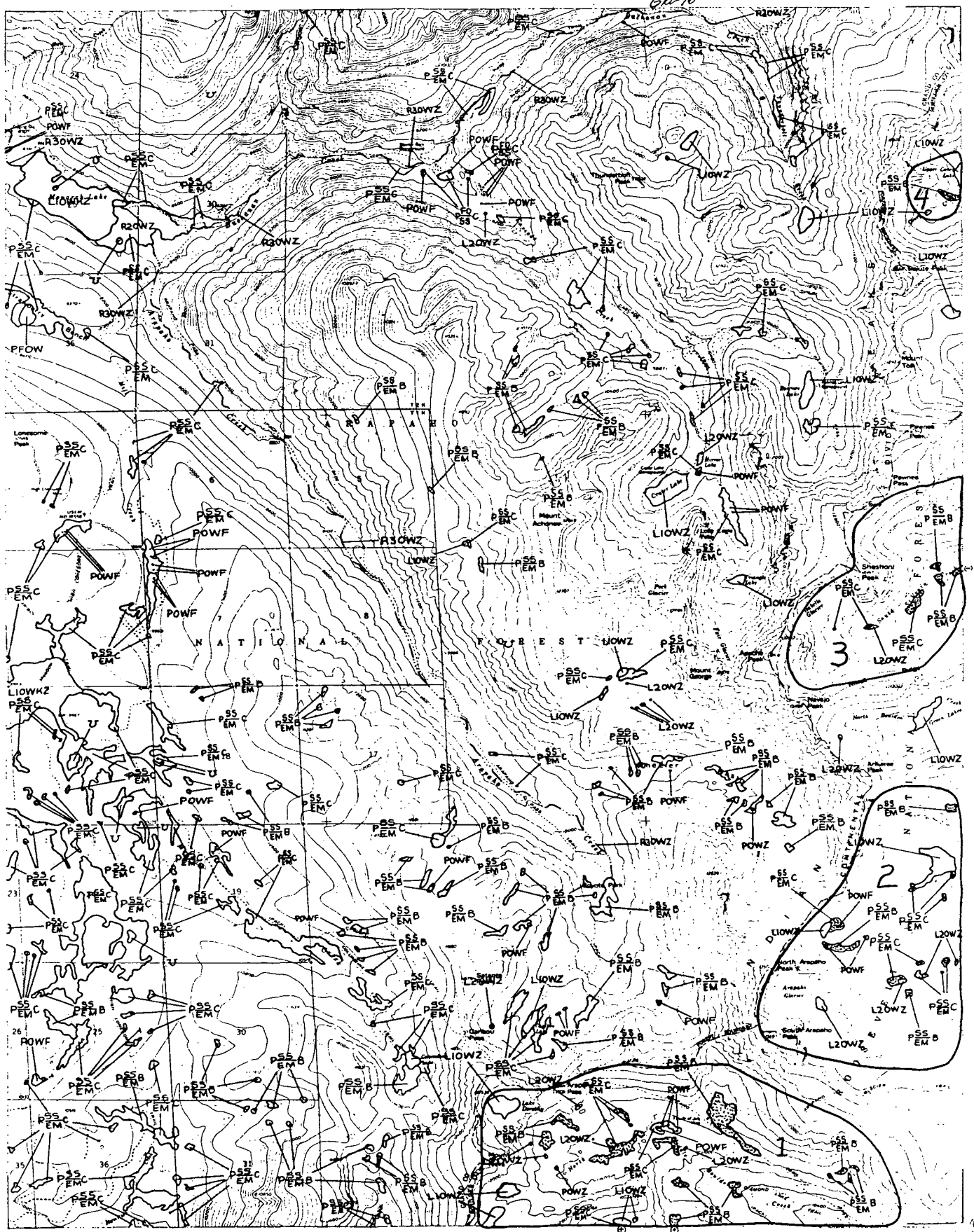
LONGS PEAK, COLO

40° 15'  
105° 30'



NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

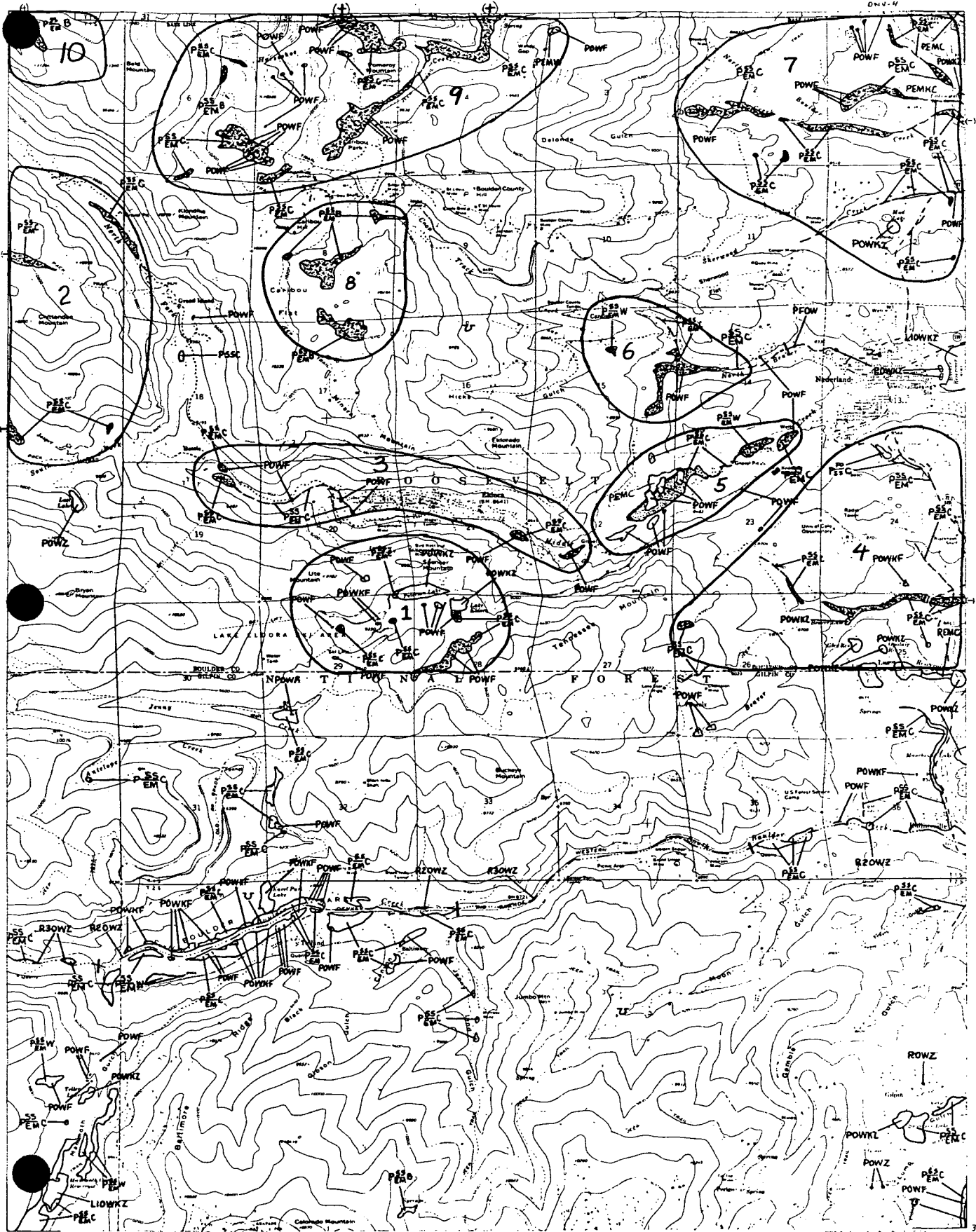
Monarch Lake





NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

Nederland



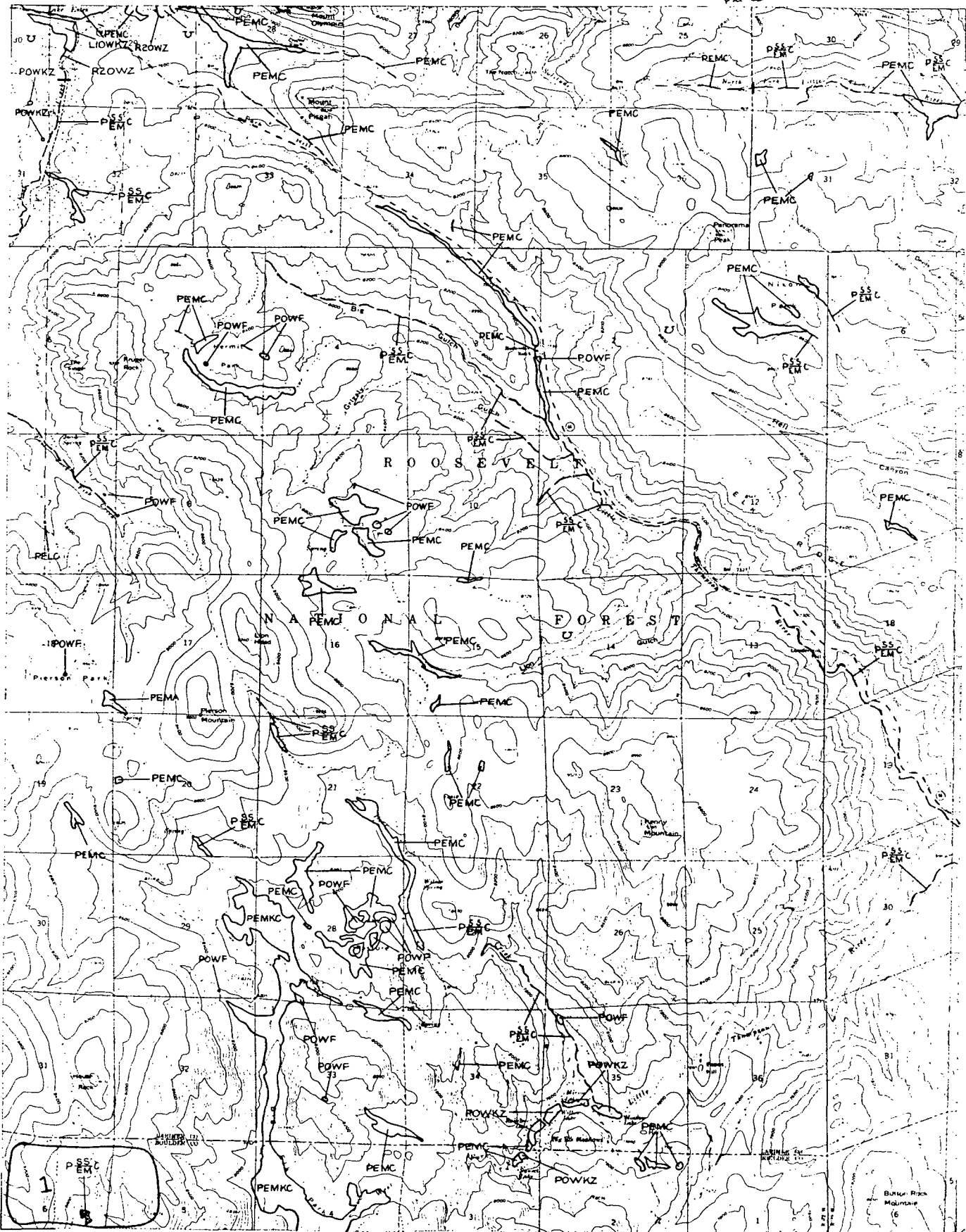
104° 30' W  
39° 52' 30" N

NEDERLAND, COLO

NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

Panorama Peak

021-26



GREELEY SW  
ESTES PARK

105°22' 30"

PANORAMA PEAK, COLO.

NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

Raymond

42-5



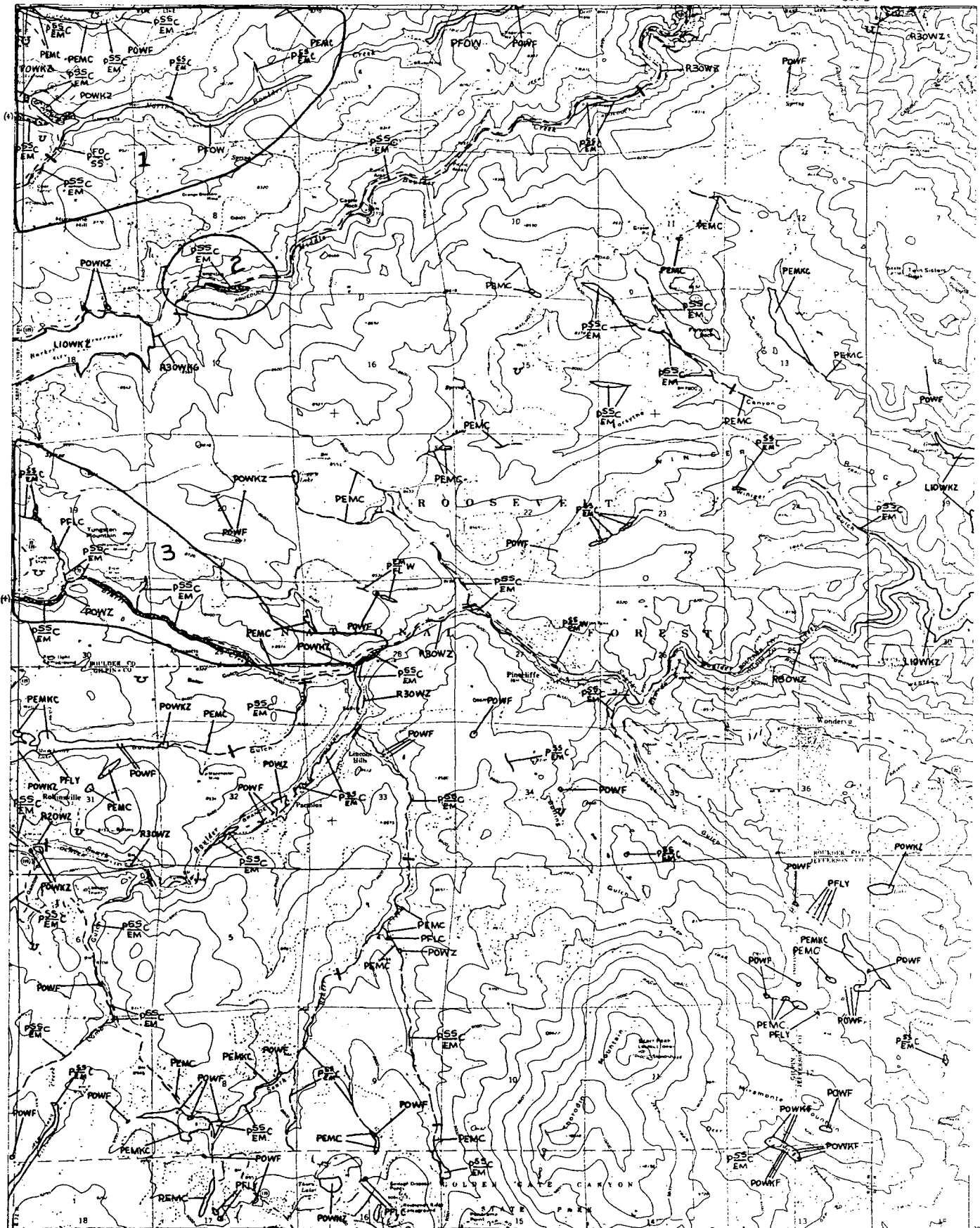
GREELEY SW  
ESTES PARK

RAYMOND, COLO.

40°07'30"  
107°22'30"

NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

Tungsten



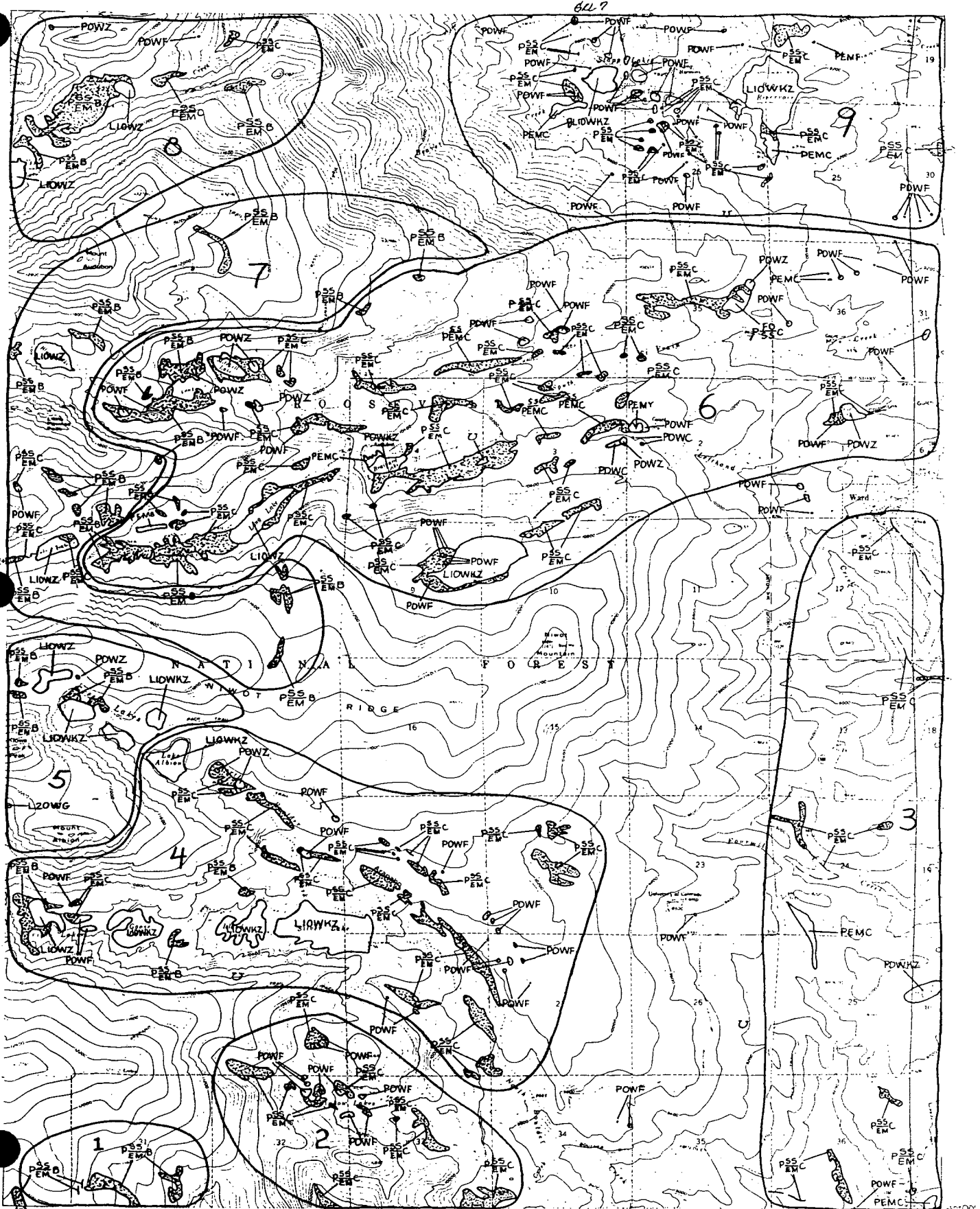
DENVER NW  
DENVER WEST

10522 30

TUNGSTEN CO.0

NATIONAL WETLANDS INVENTORY  
UNITED STATES DEPARTMENT OF THE INTERIOR

Ward



GREELEY SW  
ESTES PARK, CO

WARD 010

## APPENDIX III

The following three tables present information on the number and sizes of montane, subalpine and alpine willow carrs in Boulder County.

TABLE III-1

## Number and Sizes of Montane Willow Carrs

Size (acres)	# in size category	% of total number	Total acres in size category	% of total acreage
1	30	32%	30	6%
2	12	13%	24	5%
3	10	11%	30	6%
4	10	11%	40	8%
5	8	9%	40	8%
6	3	3%	18	3%
7	6	4%	42	8%
8	2	2%	16	3%
9	4	4%	36	7%
11	2	2%	22	5%
12	1	1%	12	2%
13	1	1%	13	2%
14	2	2%	28	6%
15	1	1%	15	3%
17	1	1%	17	4%
18	1	1%	18	4%
19	1	1%	19	4%
77	1	1%	77	16%
Total	94	100%	497	100%

## Number and Sizes of Subalpine Willow Carrs

Size (acres)	# in size category	% of total number	Total acres in size category	% of total acreage
1	74	38%	74	6%
2	36	18%	72	6%
3	14	7%	42	4%
4	8	4%	32	3%
5	10	4%	50	4%
6	6	3%	36	3%
7	6	3%	42	4%
8	1	1%	8	1%
9	3	1%	27	2%
10	3	1%	30	2%
11	3	1%	33	3%
13	2	1%	26	2%
15	1	1%	15	1%
18	7	4%	126	11%
20	3	1%	60	5%
21	1	1%	21	2%
23	1	1%	23	2%
25	1	1%	25	2%
26	2	1%	52	4%
30	2	1%	60	5%
33	1	1%	33	3%
34	1	1%	34	3%
35	1	1%	35	3%
46	1	1%	46	4%
55	1	1%	55	4%
60	1	1%	60	5%
72	1	1%	72	6%
Total	191	100%	1189	100%



## Number and Sizes of Alpine Willow Carrs

Size (acres)	# in size category	% of total number	Total acres in size category	% of total acreage
1	56	46%	56	16%
2	26	22%	52	13%
3	13	11%	39	10%
4	9	7%	36	9%
5	5	4%	25	6%
6	1	1%	6	2%
7	3	2%	21	5%
8	2	2%	16	4%
10	1	1%	10	3%
13	1	1%	13	3%
18	1	1%	18	5%
19	1	1%	19	5%
75	1	1%	75	19%
Total	120	100%	386	100%

## APPENDIX IV

Summary of vegetation data - percent cover of dominant species and species groups, and shrub heights - for four willow carrs.

TABLE IV-1

Percent cover of important species and species groups and water in two montane, one subalpine, and one alpine willow carr. <sup>a/</sup>

Species and Species Groups	Copeland (Montane)	Tucker (Montane)	Brainard Lake (Subalpine)	Bunker Hill (Alpine)
Geyer willow ( <u>Salix geyeriana</u> )	9	27	-	-
Mountain willow ( <u>Salix monticola</u> )	31	13	-	-
Blue willow ( <u>Salix subcoerulea</u> )	2	-	-	-
Strapleaf willow ( <u>Salix ligulifolia</u> )	-	2	-	-
Willow species, mostly Planeleaf willow ( <u>Salix planifolia</u> )	-	-	54	35
River birch ( <u>Betula fontinalis</u> )	25	-	-	-
Bog birch ( <u>Betula glandulosa</u> )	-	-	9	-
Mountain alder ( <u>Alnus tenuifolia</u> )	-	2	-	-
Other shrubs	3	2	-	-
Coniferous trees	-	-	1	7
Forbs	-	2 <sup>b/</sup>	-	-
Grasses (mostly <u>Calamagrostis canadensis</u> and <u>Poa</u> spp.)	6	17 <sup>d/</sup>	3 <sup>c/</sup>	10
Sedges (mostly <u>Carex aquatilis</u> )	-	5	32	45
Rushes	-	1	-	-
Water <sup>e/</sup>	22	25	1	1
TOTAL	98	96	100	98

<sup>a/</sup> Data based on hits at 5-meter intervals along six 50-m line-intercept transects in each carr.

<sup>b/</sup> Mostly Tall Mertensia (Mertensia ciliata) and White Clover (Trifolium repens).

<sup>c/</sup> Forbs and grasses grouped together. Forbs mostly Tall Mertensia and Arrowhead Butterwort (Senecio triangularis). Grasses mostly reedgrass (Calamagrostis sp.).

<sup>d/</sup> Also includes Tufted Hairgrass (Deschampsia caespitosa), 2%, and Timothy (Phleum pratense), 2%.

<sup>e/</sup> At first glance it seems paradoxical that the mesic montane carrs have so much more cover of water than the wet subalpine and alpine carrs. The reason for this is that the montane carrs have much unvegetated open water in the form of creek and beaver ponds, while the subalpine and alpine carrs have little open water, but their poorly drained peaty soils are much more saturated.

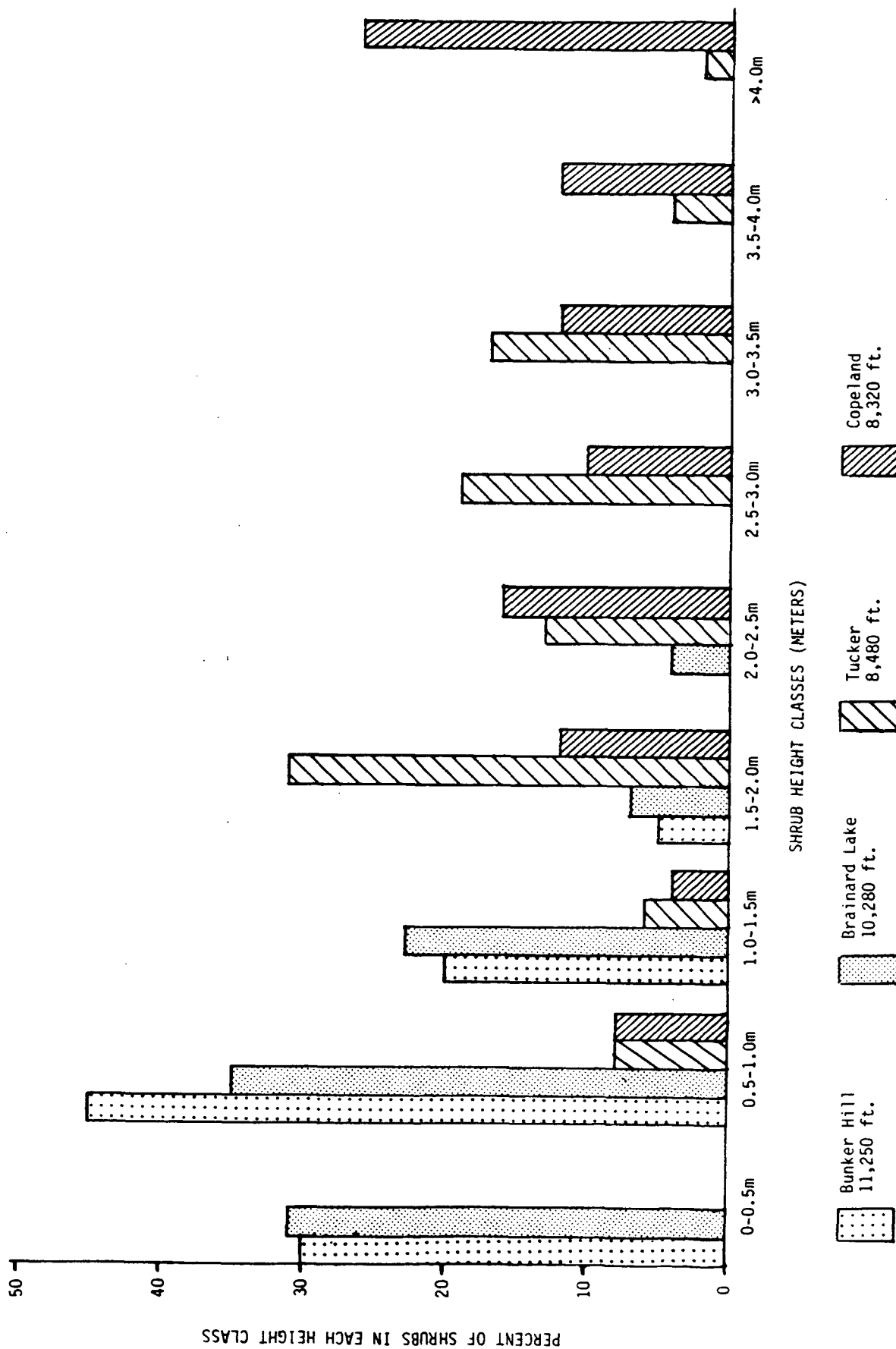


Figure IV-1. Comparison of shrub heights in the alpine (Bunker Hill), subalpine (Brainard Lake), and montane (Tucker and Copeland) willow carrs. Based on measurements at fixed intervals along six 50-meter transects in each carr.

## APPENDIX V

## Additional Information Concerning Copeland Willow Carr

At 77 acres, Copeland Willow Carr in Wild Basin is the largest montane carr in Boulder County. Most of the site is an inholding in Rocky Mountain National Park owned by the City of Longmont. The city retained ownership to reserve the option of constructing a reservoir at the site. Prior to 1985 about one half of the carr was subjected to intensive horse grazing in the summer months.

The City of Longmont, National Park Service, Colorado Natural Areas Program, Boulder County Parks and Open Space Department, and the Boulder County Nature Association held a series of discussions in 1984 and 1985 to review the ecological significance and management of Copeland Carr. At this time Longmont announced that plans for a reservoir had been abandoned, since the engineering and technology necessary to anchor a dam to the deep Pleistocene gravels at the site does not currently exist. The city also agreed to remove horse grazing, and to register the site as a Colorado Natural Area.

To clear the way for National Park Service management, Longmont also agreed to rescind a request for exclusion from the park boundary. However, the city desires to retain the property until the high mountain reservoirs (Pear, Bluebird, Sandbeach) issue is resolved. The Copeland Carr site is needed as a base of operations to repair these reservoirs if the city and federal government cannot agree on the terms of removing them.

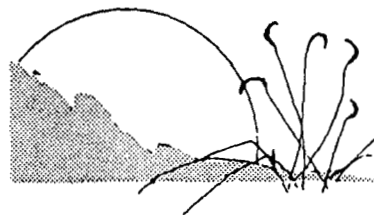
To summarize, significant progress has been made to protect the Copeland Willow Carr. Complete protection depends upon the purchase and removal of the high mountain reservoirs in Wild Basin. The Longmont City Council, and Dave Plumb of the Longmont Utilities Department, are to be commended for their efforts to protectively manage this site.

Boulder County Nature Assn.  
3893 North 75th Street  
Boulder, CO 80301

# Boulder County Nature Association

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**YOUR INTERESTS:** In the space below, please provide information about your interests relative to the Association. This can include research projects that would interest you, programs you might like to give, or other skills you can offer the Nature Association:



### What is BCNA ?

The BCNA is a non-profit, public charity organization dedicated to fostering an awareness, understanding and appreciation for the natural history and heritage of Boulder County. Associated with the County Parks & Open Space Department, BCNA will help collect, interpret and disseminate natural and cultural resource information about features which contribute to the desirable environment and life-style in the Boulder County region.

### Activities

Three functions have been identified as the basis of activity for the BCNA:

#### • Natural and Cultural History Data Base -

One of our continuing tasks is gathering current knowledge about Boulder County's natural and cultural history. This includes a bibliography of such materials as natural area studies, flora and fauna studies, historical research, wildlife inventories, weather phenomena and geology research. Copies are available to members.

#### • Environmental and Cultural Research -

By piecing together what is known comes the ability to discover what is not known. BCNA identifies informational needs, encourages and supports new scientific investigation and research. Studies are conducted by BCNA members, other individuals, or non-profit groups such as universities.

#### • Environmental Education -

A major function is dissemination of natural and cultural history information to the public through such avenues as nature hikes, slide programs, publications, seminars, and support for interpretive facilities in the County. Many of the educational activities support the existing County Parks & Open Space "Discover Nature" program.

### Your role in BCNA

The strength of BCNA lies in active member support. All members have a vote in the Association and can become involved in the various committees - from data collection, to research, to interpretive services. The membership also elects a Board of Directors which provides guidance for the Association and sets priorities. Members can take advantage of publications, nature classes, and seminars at discount rates.

### Financial Support

BCNA funds come entirely from member dues, donations and publication sales. As a non-profit corporation, BCNA also has the ability to acquire and hold real and personal property as appropriate toward furthering the objectives of the Association.

-----  
**MEMBERSHIP APPLICATION**  
Boulder County Nature Association

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Telephone # \_\_\_\_\_

- \_\_\_ Student and Senior Citizen (65+) \_\_\_\_\_ \$5
- \_\_\_ General Member \_\_\_\_\_ \$10
- \_\_\_ Family \_\_\_\_\_ \$15
- \_\_\_ Subscribing Member \_\_\_\_\_ \$30
- \_\_\_ Life Member \_\_\_\_\_ \$300
- \_\_\_ Corporate Member \_\_\_\_\_ \$500

Members receive a quarterly newsletter and discounts on BCNA publications. Additionally, there are quarterly seminars and outings. Subscribing members receive publications free of charge.

The membership year is January 1 through December 31. Make check or money order payable to *Boulder County Nature Association* and mail to: BCNA, 3893 North 75th Street, Boulder, CO 80301