A PRELIMINARY SURVEY OF AVIAN SPECIES OF SPECIAL CONCERN ON THE CITY OF BOULDER'S DOUDY DRAW AND ELDORADO MOUNTAIN PROPERTIES

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SUMMARY

A one season breeding bird study was conducted to determine the status of species of special concern (including federally listed, state listed, and county listed species) on the City of Boulder's Doudy Draw and Eldorado Mountain Open Space properties. Between 15 May and 15 July, 1993 a total of 60 field hours were spent searching for breeding birds within all major terrestrial habitats. Nest locations for species of concern were noted on a 7-1/2' topographic map. Potential breeding species were coded as "possible," "probable," or "confirmed" breeders based on observed behaviors. Data from these 1993 breeding season observations were supplemented by data from the Boulder County Monthly Wildlife Inventory (Boulder County Audubon Society, 1975-93) and from breeding bird surveys conducted in the area between 1987-9 by the Colorado Breeding Bird Atlas Partnership (Hugh Kingery, pers. comm.) to compile a comprehensive list of potential breeding species within the study area.

A total of 93 potential breeding species were observed from 1985-93. Of this total 49 species definitely nested within the study area (confirmed breeders), 18 species showed strong evidence of nesting (probable breeders), and 26 species may have nested (possible breeders). An additional 39 non-breeding species were observed within the study area from 1985-93.

Bald eagles (federal endangered) roosted within the study area throughout the winters of 1987-93. During spring, 1993 a pair of

mature bald eagles initiated nest construction at Stanley Lake, 20 km east of Doudy Draw. This pair was observed flying over Eldorado Mountain during March and April, 1993 (Michael Carter, pers. comm.). A peregrine falcon (federal endangered), was observed flying over Spring Brook on 23 August, 1993. Peregrine falcons nested successfully in the Shadow Canyon region of the Boulder Mountain Park, approximately 3 km north of the study area, from 1991-93 (Rod Moraga, pers. comm.). Suitable peregrine falcon nesting sites were identified within the study area on the east slope of Eldorado Mountain. A pair of prairie falcons occupied this nesting area during the 1993 breeding season, fledging four young.

The study area contains several habitats that support unusually high concentrations of breeding birds. The foothills shrublands in Doudy Draw are the most extensive representation of this ecosystem within the entire Boulder Mountain Parks and Open Space system. These shrublands provide nesting habitat for at least nine species of national or local concern: scrub jay, gray catbird, northern mockingbird, sage thrasher, cedar waxwing, loggerhead shrike, yellow warbler, American redstart, and blue grosbeak. Mature ponderosa pine forest along Spring Brook supports a variety of old-growth dependent species, including northern goshawk, flammulated owl, and hairy woodpecker. The sheer sedimentary cliffs on Eldorado Mountain provide nest sites for several raptor species, including golden eagle (one of ten

documented sites in Boulder County), prairie falcon, red-tailed hawk, and turkey vulture.

With 93 potential breeding species, the study area ranks in the 99th percentile of similar-sized areas censused throughout the state by the Colorado Breeding Bird Atlas Partnership. Of approximately 1,000, 25 km^2 blocks censused, only 6 have contained more than 90 species.

STUDY AREA

The study area lies in southern Boulder County and northern Jefferson County within T2S, R70W; and T1S, R70W and R71W. The area lies at the interface between the high plains and the foothills of the Rocky Mountains. Elevations range from 1710 m in lower Doudy Draw to 2541 m at the summit of Eldorado Mountain. The study area is bounded to the north by Eldorado Springs Drive and South Boulder Creek, to the west by Eldorado Canyon State Park, to the south by private land in Jefferson County, and to the east by the City of Boulder's Flatirons Vista Open Space property.

Dominant vegetation consists of ponderosa pine/Douglas-fir forest, ponderosa pine woodland, foothills shrubland, riparian woodland, and grassland. This mixture of vegetation types, along with a severe elevation gradient, creates a diversity of breeding bird habitats. Sheer, sedimentary cliffs on Eldorado Mountain are occupied by golden eagles, prairie falcons, white-throated swifts, canyon wrens, and other cliff-nesting species. Dense ponderosa pine/Douglas fir stands on the eastern slopes of Eldorado Mountain support northern goshawks, red-breasted nuthatches, hermit thrushes, and other forest interior species. The open ponderosa pine woodlands on the mesas between Eldorado Mountain and Doudy Draw contain numerous standing dead trees where hairy woodpeckers, pygmy nuthatches, and violet-green swallows nest. Foothills shrublands in Doudy Draw support a distinct complex of shrub-nesting birds, including gray catbirds, yellow-breasted chats,

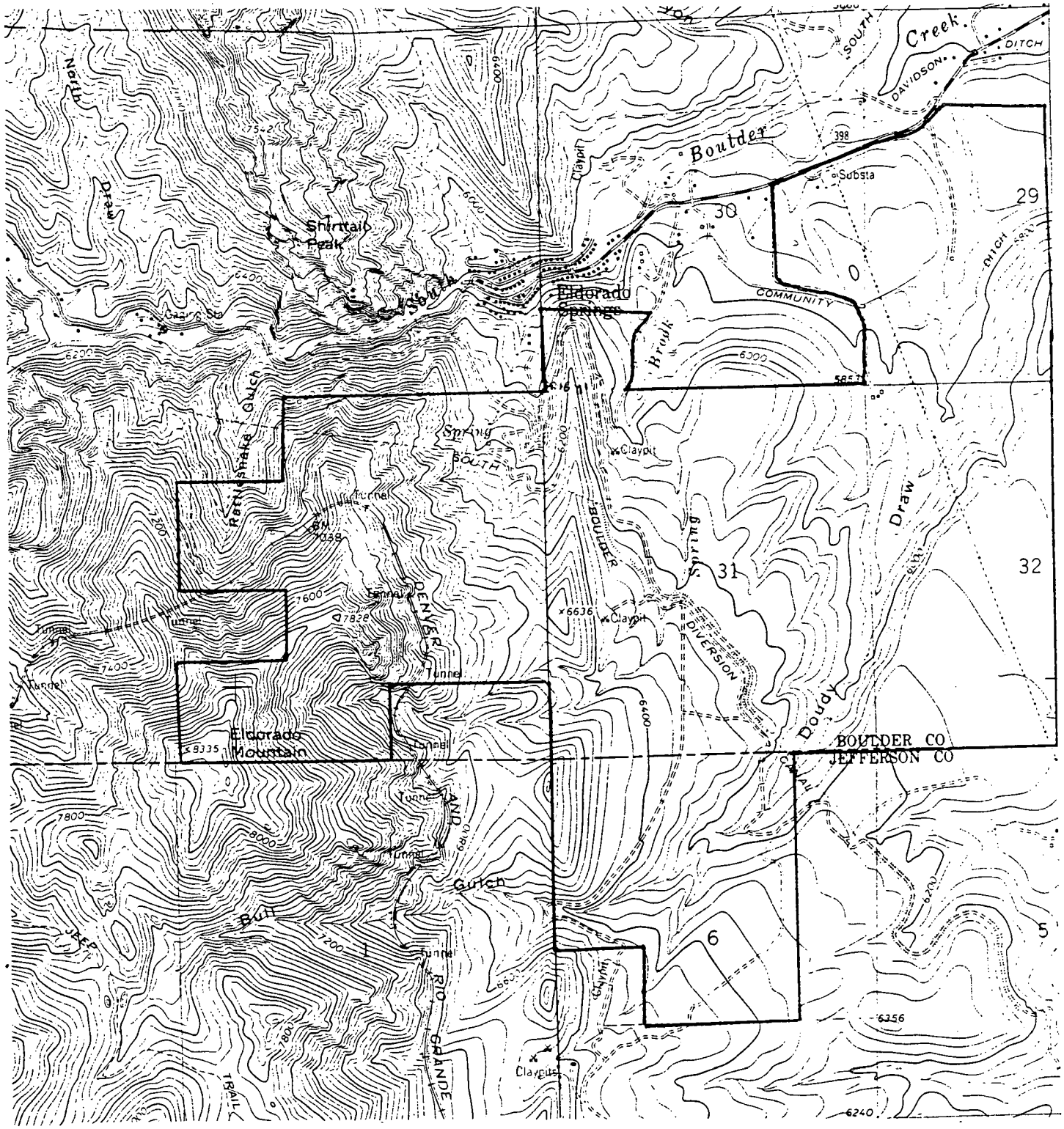

Figure 1. Study Area.

rufous-sided towhees, and lazuli buntings. Riparian woodlands and grasslands in lower Doudy Draw and cattail/sedge wetlands along Spring Brook provide additional distinct habitats for nesting birds.

Historical uses of the study area have included mining and cattle ranching. Much of the ponderosa pine/Douglas fir forest west of Doudy Draw is characterized by second growth stands of dense, stunted trees. A few pockets of more open ponderosa pine forest, with relatively large trees (50 cm DBH or more), numerous standing dead trees, and a multi-layered canopy, occur along Spring Brook and on the edge of the mesa to the west of Doudy Draw. These pockets of more open forest may have escaped logging or fire during the 19th century, or they may have matured rapidly due to favorable growing conditions. In Doudy Draw the extent of non-native grass cover and the prevalence of exotic forbs such as Klamath weed (Hypericum perforatum), false salsify (Podospermum laciniatum), and Russian knapweed (Centaurea repens) suggests a high level of disturbance of native vegetation from overgrazing.

The main line of the Denver and Rio Grande Western Railroad crosses the study area at the 2200 m level of Eldorado Mountain. The South Boulder Diversion Canal crosses the mesa between Eldorado Mountain and Doudy Draw. Public access to the study area is provided by a hiking trail in Doudy Draw and a dirt road that follows the diversion canal.

METHODS

A survey of breeding bird populations within the study area was conducted from 15 May - 31 August, 1993 using procedures established by the Colorado Breeding Bird Atlas Partnership. Atlas protocol includes:

I. Spending a minimum of 20 hours within the study area or "block."

II. Multiple visits to the study area throughout the breeding season.

III. Two or more night surveys for owls.

IV. Spending at least five hours in each major terrestrial habitat.

V. Confirming at least half of the observed species as nesters within the study area.

For this study the Atlas procedures were extended to ensure more thorough coverage. A total of 40 hours were devoted to 12 breeding bird surveys (15 and 20 May; 1, 11, 26, and 30 June; 9, 12, and 19 July; and 6, 13, and 19 August). Surveys followed mapped routes to ensure complete coverage of major terrestrial habitats (Figure 2). Five habitats were identified: grassland, riparian woodland, foothills shrubland, coniferous forest, rock and talus (Cooper 1984). During all breeding bird surveys, nesting locations of species of special concern were noted and mapped.

Information from breeding bird surveys was supplemented by information provided by City of Boulder Open Space volunteers and

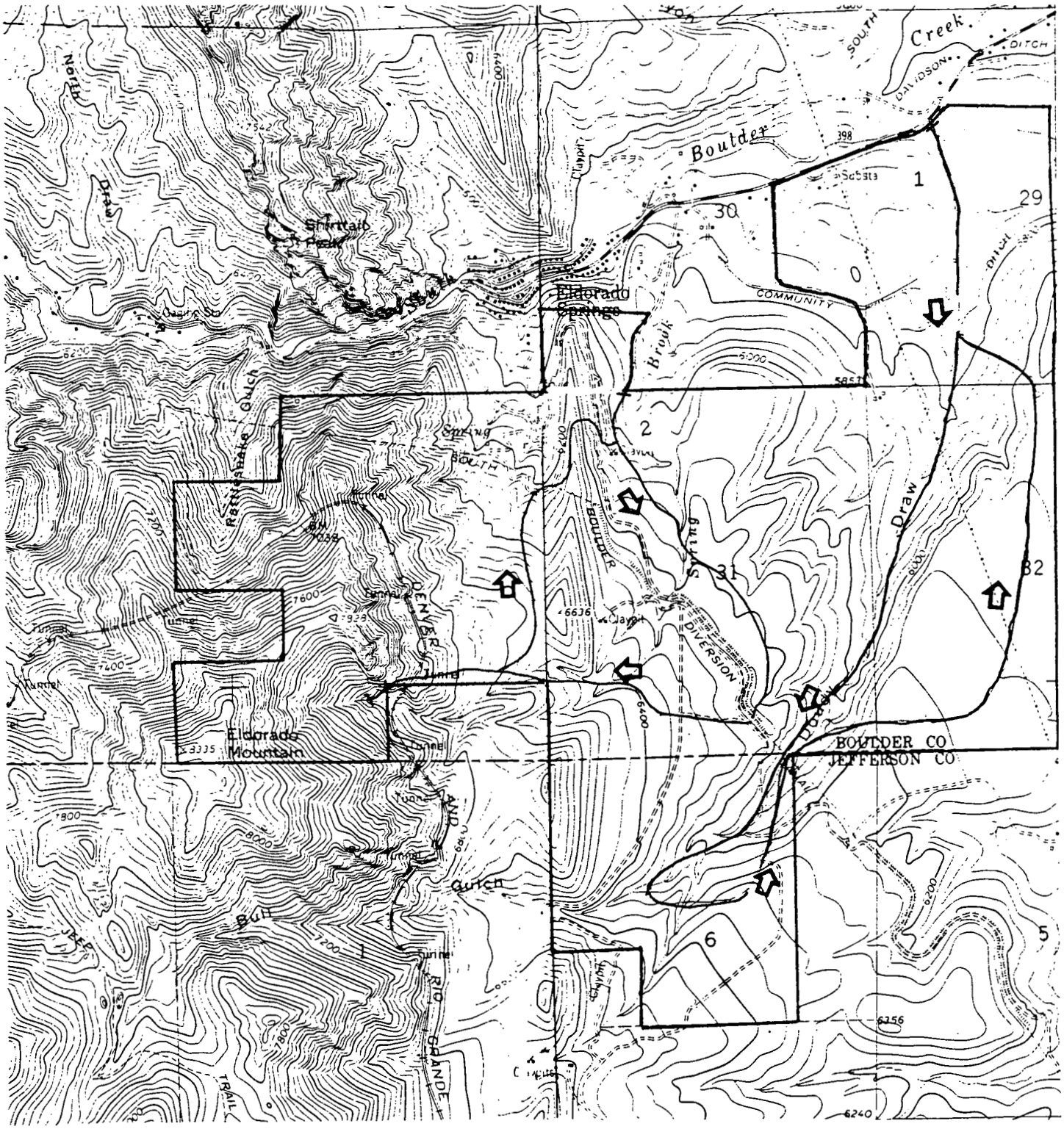

Figure 2. Survey Routes

1. Doudy Draw, 8 km
2. Eldorado Mountain, 5 km

by data from the Boulder County Monthly Wildlife Inventory (Boulder County Audubon Society 1975-93) and the Colorado Breeding Bird Atlas (Hugh Kingery, pers. comm.). All species seen or heard were classified as "possible" breeders (seen or heard in appropriate nesting habitat), "probable" breeders (strong indications of nesting, such as territorial defense or courtship), or "confirmed" breeders (evidence of nesting, such as a nest with eggs or fledged young).

Three additional trips were made to the cliffs on the east slope of Eldorado Mountain to search for raptors. Additional data on cliff-nesting raptors were provided by the City of Boulder Open Space Department (Rod Moraga, pers. comm.) and the Boulder County Nature Association (Nan Lederer, pers. comm.). Three owl surveys were conducted (1, 11 June; 8 July) along a 1.6 km survey route on Eldorado Mountain (Figure 3). Taped playbacks were used to solicit responses from territorial flammulated, northern pygmy, and northern saw-whet owls (Jones, 1991).

A list of non-breeding species within the study area was compiled using data from the Boulder Audubon Society's Christmas Bird Counts (American Birds 1985-93), the Boulder County Monthly Wildlife Inventory (Boulder County Audubon Society 1975-93), and 1993 breeding bird surveys. A list of species of special concern was generated using these data and species of concern lists prepared by the U.S. Department of Fish and Wildlife (1986, 1993), the Colorado Division of Wildlife (1993), and the Boulder County Parks and Open Space Department (1993).

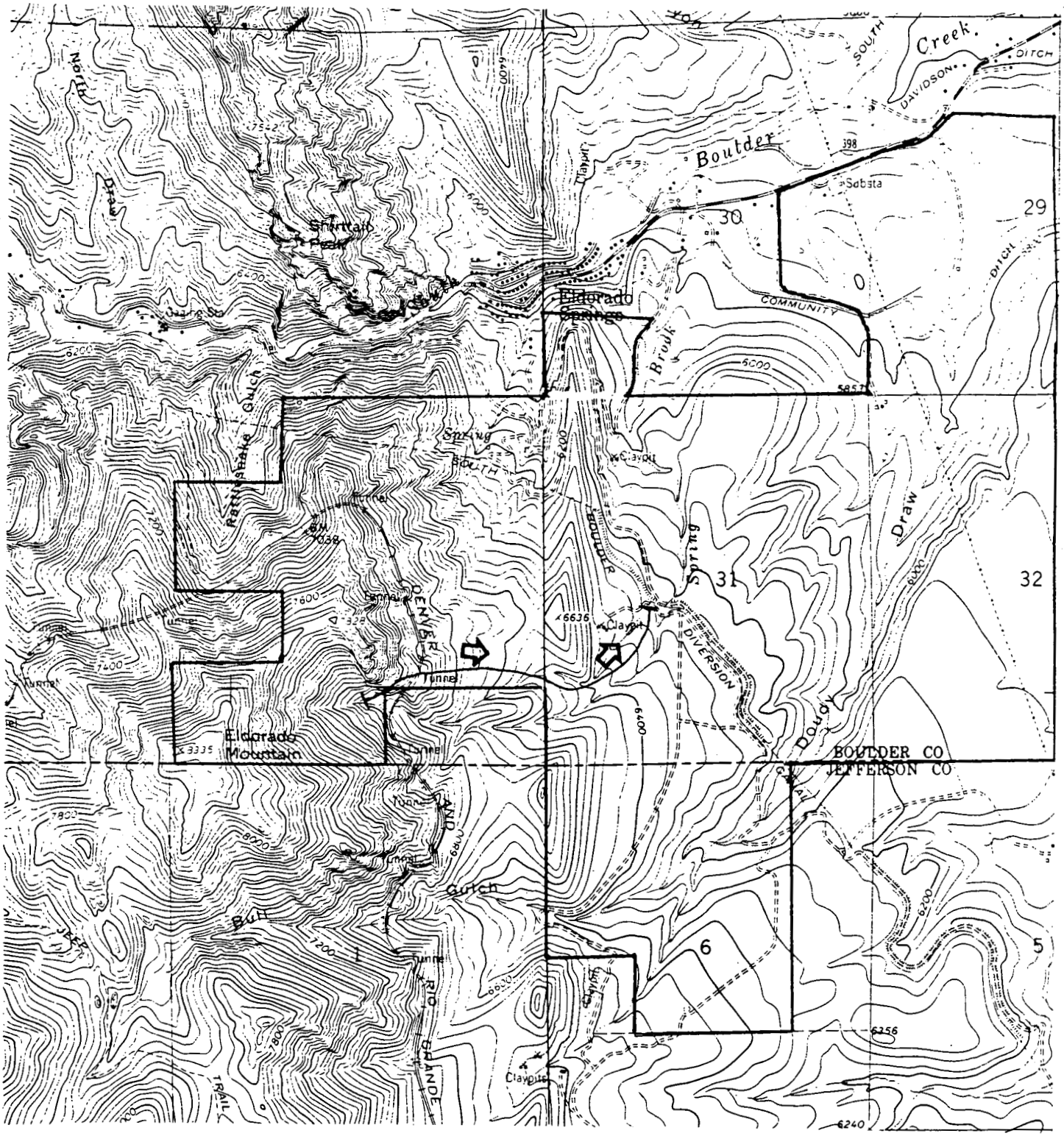

Figure 3. Small Owl Survey Route

RESULTS AND DISCUSSION

BREEDING SPECIES

A total of 89 potential breeding species were seen or heard within the study area during the 1993 breeding season (15 May-31 August). An additional four potential breeding species were seen or heard during the 1985-92 breeding seasons. Of the grand total of 93 potential breeding species, 49 species definitely nested within the study area (confirmed breeders), 18 species showed strong indications of nesting (probable breeders), and 26 species may have nested (possible breeders--Table 1).

The list of probable breeders includes many species that are secretive or difficult to detect, such as common nighthawk, common poorwill, dusky flycatcher, Virginia's warbler, and MacGillivray's warbler. Other species on the list of probables are ubiquitous but difficult to confirm. Red-breasted nuthatches and white-breasted nuthatches almost certainly nest within the study area, but their nests can be surprisingly difficult to find. Because white-throated swift nests are located on high cliffs, it is almost impossible to observe their nesting behavior. The list of possible breeders includes some difficult to detect species and some edge of range species such as western bluebird, northern mockingbird, sage thrasher, loggerhead shrike, and American redstart that may not breed or even be present in the study area every year.

In terms of species richness (total number of potential breeding species), the study area ranks in the 99th percentile of

Table 1: Breeding Species
1993 Breeding Season Observations, Unless Noted

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

Habit Codes: C--Coniferous Forest, G--Grassland, L--Lakes and Ponds,
R--Riparian Woodland, S--Shrubland, T--Rock and Talus

Abundance Codes: 1: 1 Breeding Pair, 2: 2-10 Breeding Pairs,
3: 11-100 Breeding Pairs, 4: 101-1,000 Breeding Pairs,
5: More than 1,000 Breeding Pairs

Species	Habitat	Abundance	Status	Breeding Behavior
Turkey Vulture	T	1	Pr	Pair
Sharp-shinned Hawk	C	1	Pr	Fledged young
Cooper's Hawk	C	1	Cf	Nest with young, 1987
Northern Goshawk	C	1	Po	Seen, August, 1992[1]
Red-tailed Hawk	C	1	Cf	Fledged young
Golden Eagle	T	1	Cf	Nest with eggs, 1984[2]
American Kestrel	C,R	2	Pr	Pair
Prairie Falcon	T	1	Cf	Nest with young
Blue Grouse	C	2	Po	Heard
Wild Turkey	C	2	Po	Seen
Killdeer	L	1	Pr	Distraction display
Common Snipe	L,G,S	1	Pr	Territory
Rock Dove	T	2	Cf	Used nest
Mourning Dove	C,R,S	3	Cf	Nest with young
Small Owl Species	C	2	Po	Heard
Great Horned Owl	C	2	Cf	Fledged young
Northern Pygmy Owl	C	2	Cf	Occupied nest, 1985[3]
Common Nighthawk	C	2	Pr	Courtship
Common Poorwill	C	2	Pr	Singing males
White-throated Swift	T	2	Pr	Territory
Broad-tailed Hummingbird	C,R,S	3	Cf	Fledged young
Belted Kingfisher	R	1	Po	Seen
Williamson's Sapsucker	C	2	Po	Seen
Downy Woodpecker	C,R	2	Po	Seen
Hairy Woodpecker	C	3	Cf	Occupied nest
Northern Flicker	C,R	3	Cf	Occupied nest
Olive-sided Flycatcher	C	1	Po	Seen
Western Wood-pewee	C,R	4	Cf	Feeding young
Hammond's Flycatcher	C	3	Pr	Territory

[1]John Tumasonis, pers. comm.

[2]Figgs and Lederer, 1992

[3]Mike Figgs, pers. comm.

Species	Habitat	Abundance	Status	Breeding Behavior
Dusky Flycatcher	R	2	Pr	Territory
Cordilleran Flycatcher	C	3	Pr	Territory
Tree Swallow	C	1	Po	Seen
Violet-green Swallow	C,T	3	Cf	Nest with young
Cliff Swallow	G,R	---	Po	Seen
Barn Swallow	G,R	---	Po	Seen
Steller's Jay	C	3	Cf	Fledged young
Blue Jay	R	1	Po	Seen
Scrub Jay	R,S	2	Cf	Fledged young
Black-billed Magpie	C,R	2	Cf	Nest with young
American Crow	C	1	Cf	Used nest
Common Raven	T	1	Cf	Occupied nest
Black-capped Chickadee	R	2	Cf	Fledged young
Mountain Chickadee	C	3	Cf	Fledged young
Red-breasted Nuthatch	C	3	Pr	Territory
White-breasted Nuthatch	C	3	Pr	Territory
Pygmy Nuthatch	C	3	Cf	Fledged young
Brown Creeper	C	2	Po	Seen
Canyon Wren	T	2	Cf	Occupied nest
House Wren	C,R,S	4	Cf	Feeding young
Ruby-crowned Kinglet	C	2	Po	Singing male
Blue-gray Gnatcatcher	C,R	1	Cf	Fledged young
Western Bluebird	C	1	Po	Seen
Townsend's Solitaire	C	3	Cf	Feeding young
Hermit Thrush	C	2	Cf	Fledged young
American Robin	C,G,R	4	Cf	Fledged young
Gray Catbird	S	2	Cf	Feeding young
Northern Mockingbird	S	1	Po	Seen, June, 1987
Sage Thrasher	S	---	Po	Seen[4]
Cedar Waxwing	R,S	2	Cf	Fledged young
Loggerhead Shrike	G	---	Po	Seen, August 1986[5]
Starling	R	2	Cf	Occupied nest
Solitary Vireo	C	3	Cf	Occupied nest
Warbling Vireo	C,R	3	Pr	Territory
Virginia's Warbler	C,S	3	Pr	Territory
Yellow Warbler	R	2	Cf	Feeding young
Yellow-rumped Warbler	C	3	Pr	Territory
American Redstart	C,R	---	Po	Seen
Macgillivray's Warbler	R	2	Pr	Territory
Yellow-breasted Chat	S	3	Cf	Feeding young
Western Tanager	C	3	Pr	Territory
Black-headed Grosbeak	C,R	3	Cf	Fledged young
Blue Grosbeak	S	1	Cf	Nest building
Lazuli Bunting	R,S	3	Cf	Feeding young
Green-tailed Towhee	C,R,S	3	Cf	Fledged young

[4]Confirmed nester along Coal Creek, 3 km east of Doudy Draw.

[5]Boulder County Wildlife Inventory.

Species	Habitat	Abundance	Status	Breeding Behavior
Rufous-sided Towhee	S	3	Cf	Fledged young
Chipping Sparrow	C	4	Cf	Feeding young
Vesper Sparrow	C,G	3	Cf	Fledged young
Lark Sparrow	G	---	Po	Seen
Savannah Sparrow	G,L	---	Po	Seen
Grasshopper Sparrow	G	2	Cf	Fledged young
Song Sparrow	L,S	2	Pr	Territory
Gray-headed Junco	C	3	Pr	Territory
Red-winged Blackbird	L	1	Cf	Occupied nest
Western Meadowlark	G	3	Cf	Fledged young
Brewer's Blackbird	R	---	Po	Seen
Common Grackle	R	2	Cf	Used nest
Brown-headed Cowbird	C,R,S	3	Cf	Nest with eggs
Northern Oriole	R	1	Cf	Occupied nest
Cassin's Finch	C	2	Po	Seen
House Finch	R,S	2	Po	Seen
Red Crossbill	C,R	---	Po	Fledged young
Pine Siskin	C	4	Pr	Pair
Lesser Goldfinch	C,R,S	3	Cf	Feeding young
American Goldfinch	R,S	3	Cf	Feeding young

breeding bird blocks censused within Colorado from 1985-93 using breeding bird atlas methodology. Approximately 1,000, 25 km^2 atlas blocks have been censused throughout Colorado. Observers spending approximately 10-50 hours in each block have found more than 90 species in only 6 blocks throughout the state. The mean number of species in 14 atlas blocks completed in Boulder County was 61.4 (Hugh Kingery, pers. comm.).

The high number of breeding bird species found within the study area is not surprising given the area's elevation range (almost 1000 m) and habitat diversity. The Boulder Mountain Park, which is about three times the size of the study area and contains similar habitats, supports a documented breeding bird population of 101 species (Jones 1990). The presence of relatively undisturbed habitats in both the mountain park and the study area contributes to the richness of these areas' breeding bird populations. Northern goshawks, which have been documented in both areas, are largely restricted to dense, unfragmented forests along the Front Range (Shuster 1976). Gray catbirds, which also nest in both areas, are found only in dense mesic shrublands along the base of the foothills (Boulder Audubon Society 1975-93, Jones 1990). Nesting prairie falcons and golden eagles are largely restricted to sheer sedimentary cliffs in the Front Range foothills (Figgs and Lederer 1993).

NON BREEDING SPECIES

A total of 39 non-breeding species were observed within the study area from 1985-93 (Table 2). Non-breeders include migrants such an pinyon jay and orange-crowned warbler; winter visitants such as Clark's nutcracker, northern shrike, and Bohemian waxwing; and summer visitants that breed outside the study area such as great blue heron, northern harrier, and peregrine falcon. The Doudy Draw area has the reputation among local birdwatchers as a good place to see rare migrants (Alex and Gillian Brown, co-compilers, Boulder County Wildlife Inventory, pers. comm.). The following rare non-breeders were seen in Doudy Draw between 15 May and 31 August, 1993: a peregrine falcon on 23 August, an ash-throated flycatcher on 20 May and 6 June (the 7th BCWI sighting since 1975), and a summer tanager on 28 May (the 13th BCWI sighting since 1975).

Dense shrub growth in Doudy Draw probably attracts migrants that are rarely seen in Boulder County. Because Doudy Draw is one of the few north-facing canyons along the mountain/plains interface of Boulder County, it also may "trap" fall migrants as they move south.

Table 2: Non-breeding Species

Sources:

BCC--Boulder Christmas Count, 1985-93
BCWI--Boulder County Wildlife Inventory, 1985-93
CBBA--Colorado Breeding Bird Atlas, 1985-93

Species	Status	Source
Great-blue Heron	Summer visitant	Pers. obs.
Canada Goose	Year round visitant	Pers. obs.
Green-winged Teal	Year round visitant	BCC
Mallard	Summer visitant	Pers. obs.
Bald Eagle	Winter visitant	BCC/BCWI
Northern Harrier	Winter visitant	Pers. obs.
Ferruginous Hawk	Winter visitant	BCWI
Rough-legged Hawk	Winter visitant	BCWI
Merlin	Migrant	BCWI
Peregrine Falcon	Year round visitant	Rod Moraga, pers. comm.
Franklin's Gull	Migrant	Pers. obs.
Chimney Swift	Summer visitant	BCWI
Rufous Hummingbird	Migrant	BCWI
Red-naped Sapsucker	Migrant	BCWI
Ash-throated Flycatcher	Migrant	Pers. obs.
Say's Phoebe	Summer visitant	BCWI
Western Kingbird	Summer visitant	BCWI
Eastern Kingbird	Summer visitant	John Tumasonis, pers. comm.
Horned Lark	Winter visitant	BCWI
Pinyon Jay	Migrant	Pers. obs./BCWI
Clark's Nutcracker	Winter visitant	Pers. obs./BCWI
Rock Wren	Summer visitant	BCWI
American Dipper	Winter visitant	Pers. obs./BCWI
Golden-crowned Kinglet	Winter visitant	Pers. obs./BCC
Mountain Bluebird	Migrant	Pers. obs./BCWI
Eastern Bluebird	Winter visitant	BCWI
Swainson's Thrush	Migrant	Pers. obs.
American Pipit	Migrant	John Tumasonis, pers. comm.
Northern Shrike	Winter visitant	Pers. obs./BCWI
Orange-crowned Warbler	Migrant	Pers. obs./BCWI
Wilson's Warbler	Migrant	Pers. obs./BCWI
Summer Tanager	Migrant	John Tumasonis, pers. comm.
American Tree Sparrow	Winter visitant	Pers. obs./BCC
Clay-colored Sparrow	Migrant	BCWI
Brewer's Sparrow	Migrant	BCWI
White-crowned Sparrow	Winter visitant	Pers. obs.
Lark Bunting	Summer visitant	BCWI
Pine Grosbeak	Winter visitant	BCC
Evening Grosbeak	Winter visitant	BCC

RAPTORS

The Flatirons rock formation and associated canyons between Golden and Lyons support an unusually high concentration of nesting birds of prey (Jones 1989, Figgs and Lederer 1992). Fifteen nesting species have been documented in the Boulder Mountain Park, alone (Jones 1990). Eleven raptor species were seen or heard within the study area during the 1993 breeding season.

Golden eagles were seen flying over the study area during the 1993 breeding season, but no nesting activity was observed. Golden eagles nested on the Mickey Mouse Ears cliffs on Eldorado Mountain from 1983-5 (Figgs and Lederer 1992--Figure 4). The Eldorado Mountain golden eagle territory is one of approximately ten known nesting territories for this species in Boulder County (Figgs and Lederer 1992).

Prairie falcons nested on the Mickey Mouse Ears cliff in 1993, fledging four young (Rod Moraga, pers. comm.--Figure 5). Prairie falcons have nested on Eldorado Mountain or in Eldorado Canyon continuously since 1982 (Figgs and Lederer 1992). A peregrine falcon was seen flying over the study area, between Eldorado Mountain and Doudy Draw, on 23 August, 1993 (John Tumasonis, pers. comm.). Peregrine falcons nested approximately 3 km north of the study area, on South Boulder Peak and in Shadow Canyon, from 1991-93 (Rod Moraga, pers. comm.).

Turkey vultures, sharp-shinned hawks, Cooper's hawks, northern goshawks, and red-tailed hawks were all observed within the study area during the 1993 breeding season. Howard Weinberg observed a

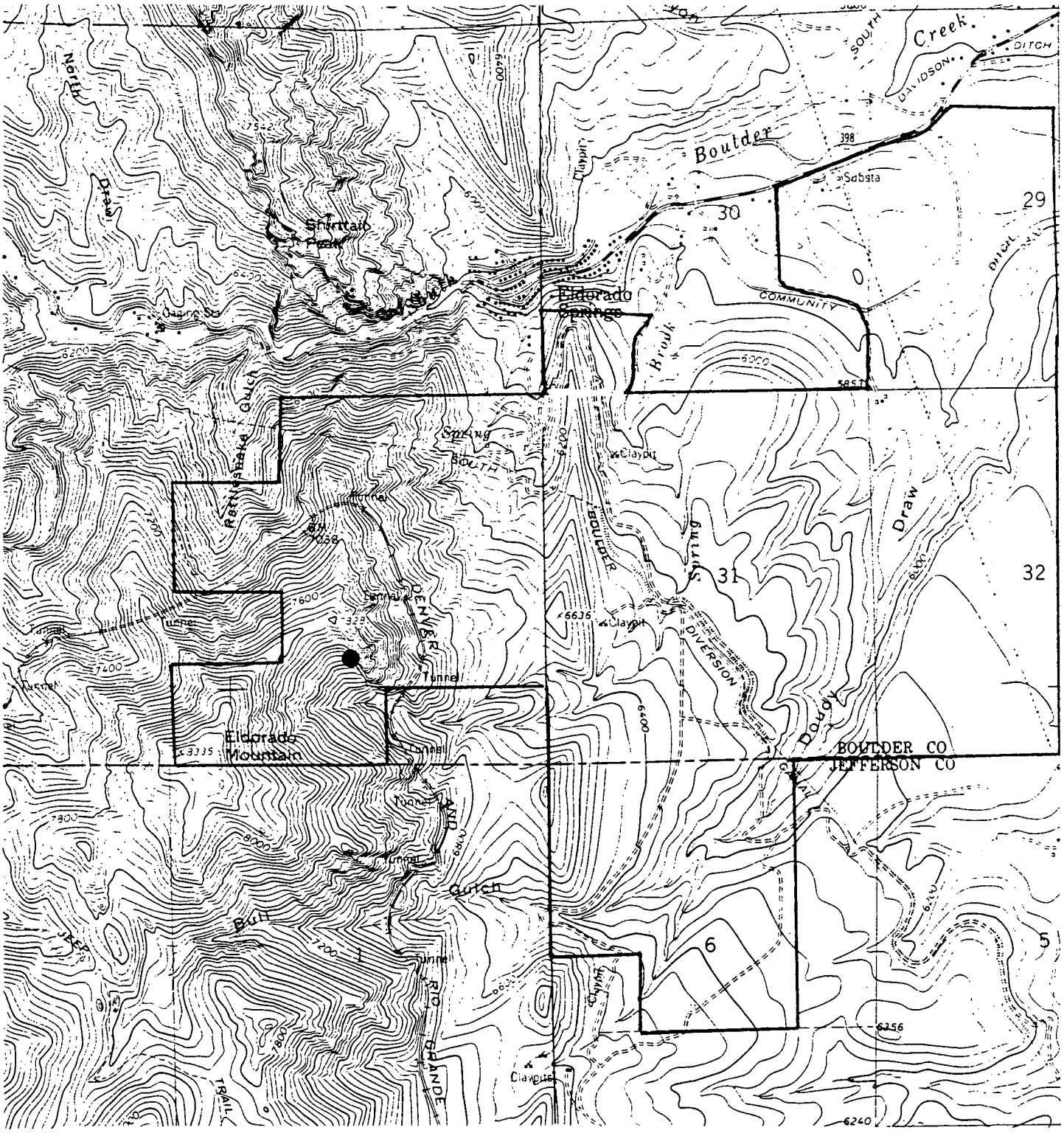

Figure 4. Golden Eagle Nest Location, 1983-5.

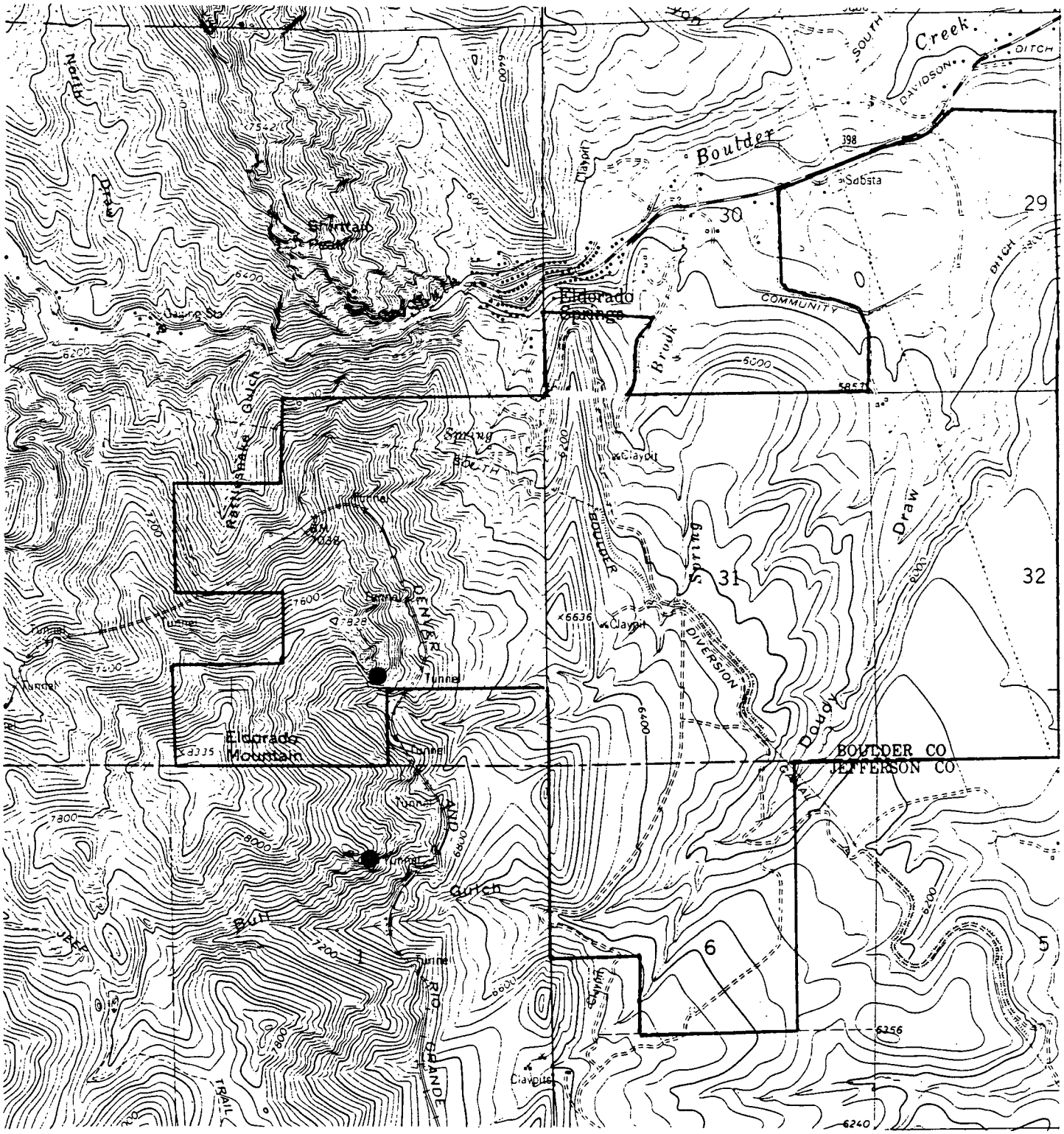

Figure 5. Prairie Falcon Nest Sites, 1993.

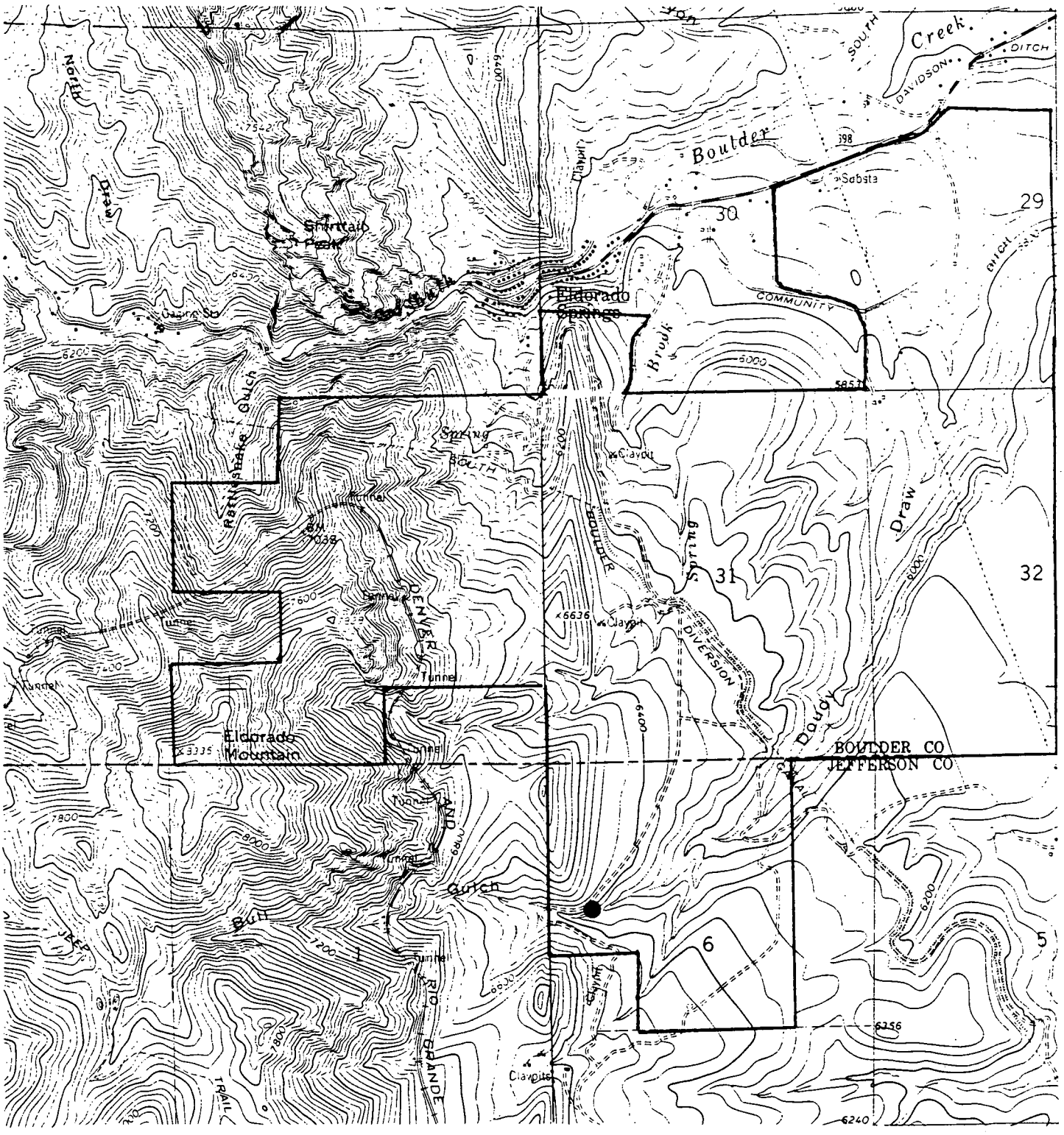

Figure 6. Cooper's Hawk Nest Location, 1986-7.

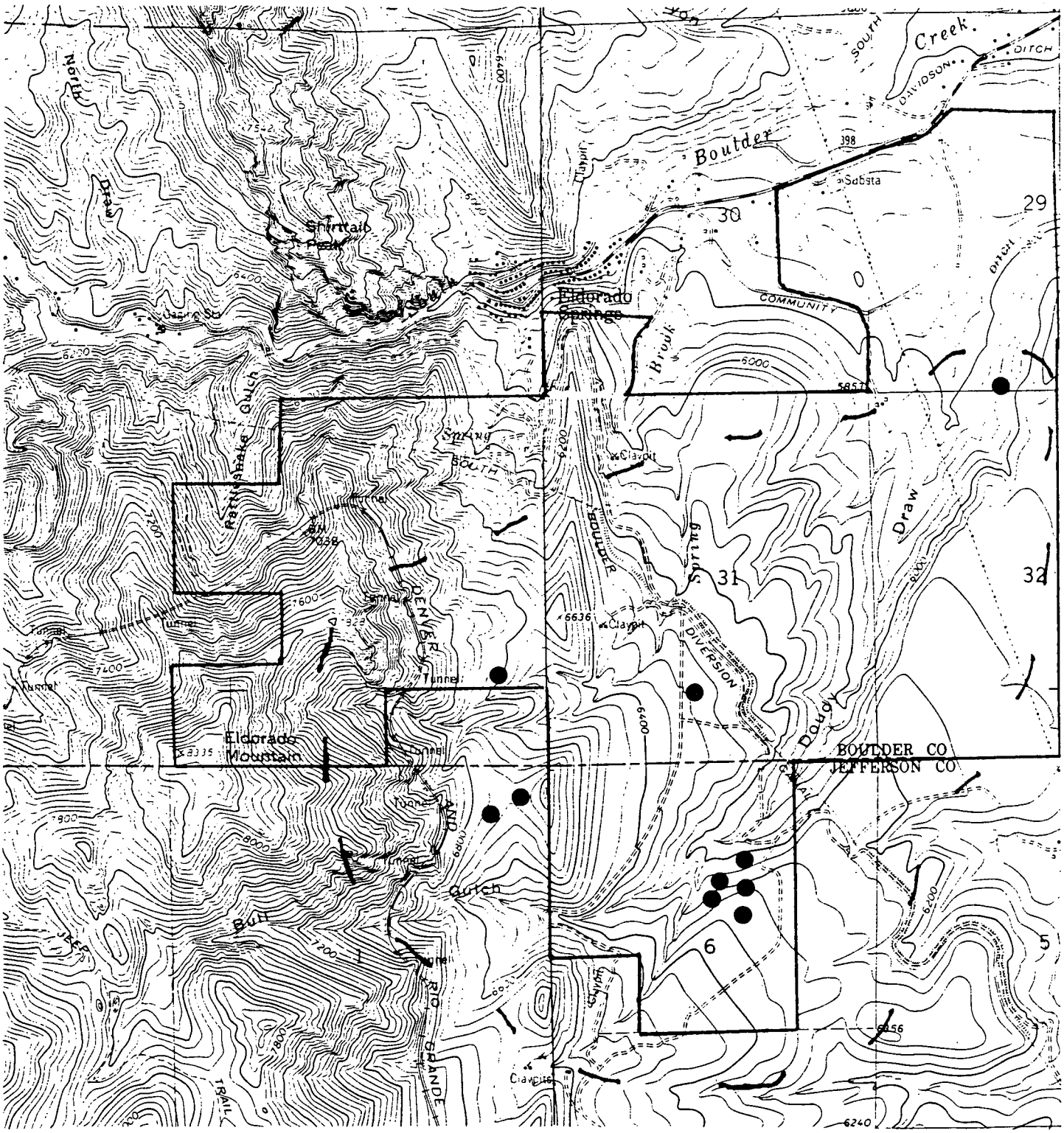

Figure 7. Red-tailed Hawk Territory and Sightings, 1993.

Cooper's hawk nest in Bull Gulch in 1986 (Weinberg 1987), and I observed a nest in a similar location in 1987 (Figure 6). I observed a pair of Cooper's hawks in Bull Gulch in May, 1993. A pair of red-tailed hawks nested on the mesa south of Bull Gulch in 1993 (Figure 7), fledging at least two young. I observed two turkey vultures soaring over the mesa between Doudy Draw and Eldorado Mountain on four occasions between 15 May and 31 August, 1993.

I observed two recently fledged great-horned owls west of Doudy Draw on 15 May, 1993. An unidentified small owl responded to a flammulated owl tape playback on 11 June, 1993, along Spring Brook 200 m west of the South Boulder Diversion Canal. Northern pygmy owls nested on the north side of Eldorado Mountain in 1985 (Mike Figgs, pers. comm.).

SPECIES OF SPECIAL CONCERN

Species of special concern are birds that have been seen or heard within the study area and appear on one or more of the following lists:

I. Federal Endangered or Threatened (U.S. Fish and Wildlife Service 1986).

II. State Species of Special Concern (Colorado Division of Wildlife 1990).

II. Rocky Mountain Region Threatened, Endangered, and Vulnerable (Finch 1992).

IV. Boulder County Species of Special Concern (Boulder County Parks and Open Space 1993).

A total of 17 species of special concern were seen or heard within the study area during the 1993 breeding season. An additional nine species were seen or heard between 1985-92 (Table 3). Species accounts follow. Management recommendations are given for species classified as probable or confirmed nesters.

Bald eagle

I. Federal endangered

Bald eagles have been observed in Doudy Draw every winter from 1987-93 (Boulder Audubon Society 1975-93, Boulder County Nature Association 1990, Rod Moraga, pers. comm.). On 15 November, 1992, I observed five bald eagles flying over the study area from east to west and disappearing behind Eldorado Mountain. These individuals may have been heading toward a nocturnal roost in the foothills.

No documentation exists of bald eagles ever nesting in Boulder County. A pair of bald eagles has nested at Barr Lake State Park, near Brighton, since 1987 (Michael Carter, pers. comm.). A second pair of bald eagles constructed a nest at Stanley Lake, west of Wheat Ridge, in March, 1993. This pair was observed foraging in the Eldorado Mountain area (Michael Carter, pers. comm.).

Numbers of wintering bald eagles reported on the Boulder Audubon and Longmont Audubon Christmas Bird Counts from 1985-93 ranged from 34-61. Breeding bald eagles usually choose nest sites along streams, lakes, and shores (Ehrlich et al. 1988, Andrews and Righter 1992). A total of 13 bald eagle pairs nested in Colorado in 1991 (Craig 1991).

Table 3: Species of Special Concern

Species	List	Status	Study Area
Great-blue Heron	County	Isolated pop.	Summer visitant
Green-winged Teal	County	Isolated pop.	Year round visitant
Northern Harrier	County	Rare/declining	Winter visitant
Sharp-shinned Hawk	Audubon	Blue list	Possible breeder
Cooper's Hawk	Audubon	Blue list	Confirmed breeder
Northern Goshawk	County	Declining	Possible breeder
Golden Eagle	County	Isolated pop.	Confirmed breeder
Bald Eagle	Federal	Endangered	Winter visitant
Peregrine Falcon	Federal	Endangered	Year round visitant
Prairie Falcon	County	Isolated pop.	Confirmed breeder
Common Nighthawk	Audubon	Blue list	Probable breeder
Hairy Woodpecker	Audubon	Blue list	Confirmed breeder
Olive-sided Flycatcher	County	Vulnerable	Possible breeder
Scrub Jay	Audubon	Blue list	Confirmed breeder
American Dipper	County	Isolated pop.	Winter visitant
Gray Catbird	County	Isolated pop.	Confirmed breeder
Northern Mockingbird	County	Rare/Isolated	Possible breeder
Sage Thrasher	County	Rare/Isolated	Possible breeder
Cedar Waxwing	County	Isolated pop.	Confirmed breeder
Loggerhead Shrike	County	Rare/Declining	Summer visitant
Yellow Warbler	Audubon	Blue list	Confirmed breeder
American Redstart	County	Rare	Possible breeder
Blue Grosbeak	State	Undetermined	Confirmed breeder
Lark Bunting	County	Rare/Declining	Summer visitant
Savannah Sparrow	County	Isolated pop.	Possible breeder
Grasshopper Sparrow	Audubon	Blue list	Confirmed breeder

Peregrine Falcon

I. Federal Endangered

A peregrine falcon was observed flying over the mesa between Doudy Draw and Eldorado Mountain on 23 August, 1993 by John Tumasonis. A second peregrine falcon was observed just outside the study area, at the intersection of Eldorado Spring Drive and Highway 93, in March, 1993 by Rod Moraga. From 1991-93 there were two or three active peregrine falcon nest sites in Boulder County (Boulder County Parks and Open Space 1993). The most productive of these sites was in the Shadow Canyon area of the Boulder Mountain Park, about 3 km north of the study area. This site fledged six young from 1991-93 (Rod Moraga, pers. comm.). In 1993 these peregrine falcons nested on the north side of Shadow Canyon in a site previously occupied by prairie falcons. Within the study area, the Mickey Mouse Ears Cliff prairie falcon nest site appears suitable for colonization by peregrine falcons in the future.

Great Blue Heron

Boulder County (Audubon Blue List)

I observed a single great blue heron at the small pond north of the point where the diversion canal crosses Doudy Draw on 11 June, 1993. Great blue herons nest at a single location in Boulder County along Boulder Creek east of 95th street.

Green-Winged Teal

Boulder County (Isolated Population)

Green-winged teal have been observed within the study area during fall and spring migration (Boulder County Wildlife Inventory). None were seen during the 1993 breeding season. Suitable nesting habitat is lacking.

Northern Harrier

Boulder County (Rare and Declining; Isolated Population)

Northern harriers have been seen within the study area during fall and spring migration (Boulder County Wildlife Inventory). No harriers were seen during the 1993 breeding season. Suitable nesting habitat is lacking.

Sharp-Shinned Hawk

Boulder County (Audubon Blue List)

I observed a sharp-shinned hawk in lower Doudy Draw on 15 May, 1993. This species nests in dense Douglas-fir stands in the foothills and mountains of Boulder County (Weinberg 1987) and is a possible breeder within the study area. John Tumasonis observed recently fledged sharp-shinned hawks in Doudy Draw in August.

Cooper's Hawk

Boulder County (Audubon Blue List)

Cooper's hawks nested within the study area in 1986 and 1987 (Weinberg 1987, pers. obs.). I observed a pair of Cooper's hawks in Bull Gulch on 15 May, 1993.

Northern Goshawk

Boulder County (Declining)

John Tumasonis observed a northern goshawk flying over the mesa east of the Mickey Mouse Ears Cliffs on 12 August, 1992. This species nests in aspen groves and dense Douglas-fir stands in the foothills and mountains of Boulder County and has nested in the Boulder Mountain Park (Jones 1989).

Golden Eagle

Federal Protected

Boulder County (Isolated Population)

A pair of golden eagles nested on the Mickey Mouse Ears Cliff from 1983-5 (Figgs and Lederer 1992). I observed a single golden eagle flying over the study area on 26 April, 1993.

Prairie Falcon

Boulder County (Isolated Population)

The prairie falcon nest site on the Mickey Mouse Ears Cliff was active sporadically from 1982-93. A pair of prairie falcons occupied this site in 1993, fledging four young.

Prairie falcons nest in only about ten known locations in Boulder County (Figgs and Lederer 1992). Most of these sites are on foothills cliffs that receive heavy use from rock climbers. Annual monitoring of activie prairie falcon nests within the study area is strongly recommended. The current program of closing selected climbing routes to protect nesting falcons should be continued. Volunteers should be recruited to monitor active nests on weekends throughout April, May, and June.

Common Nighthawk

Boulder County (Audubon Blue List)

I observed several common nighthawks within the study area during the 1993 breeding season but found no evidence of nesting.

Hairy Woodpecker

Boulder County (Audubon Blue List)

Hairy woodpeckers are fairly common nesters in Boulder County (Boulder County Wildlife Inventory) but are included on the National Audubon Society's Blue List because they are thought to be declining nationally (Tate 1986). A pair of hairy woodpeckers nested within the study area along Spring Brook in 1993 (See Figure 8).

In Boulder County hairy woodpeckers typically nest in large ponderosa pine or Douglas fir snags. A study conducted in the Blue Mountains of Oregon determined that approximately 4.5 large snags/hectare (snags greater than 25 cm DBH) were necessary to

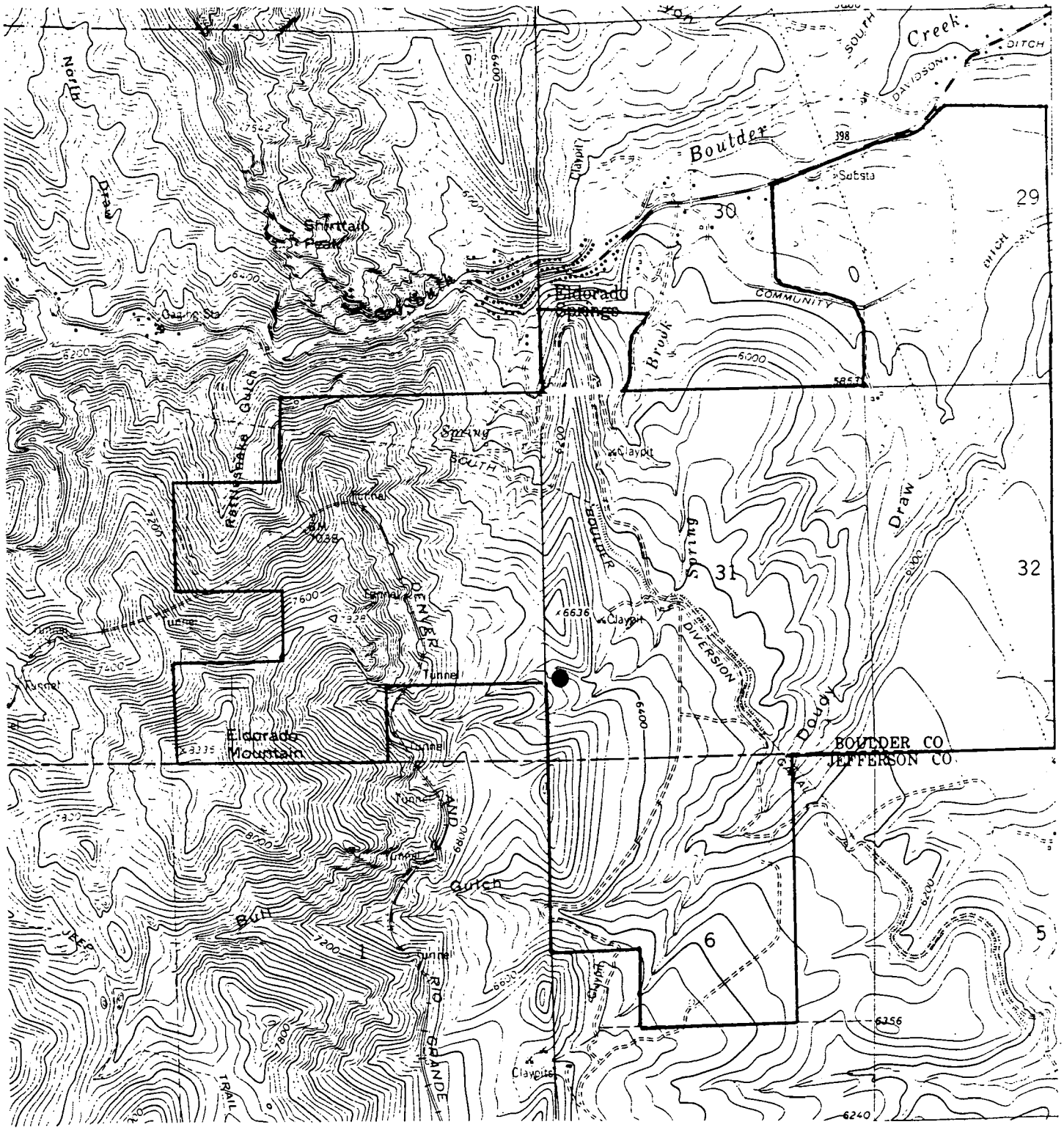

Figure 8. Hairy Woodpecker Nest Site.

maintain hairy woodpecker populations at the maximum carrying capacity (Thomas et al. 1979). Retention of all large snags within the study area will benefit this species.

Olive-Sided Flycatcher

Rocky Mountain Region (Vulnerable)

I observed a single olive-sided flycatcher in lower Bull Gulch on 15 May, 1993.

Scrub Jay

Boulder County (Audubon Blue List)

In Boulder County scrub jays typically nest in foothills shrubland, an ecosystem restricted to the 1500-2,000 m elevation range along the mountain/plains interface. During 1993 I observed a pair of scrub jays in lower Doudy Draw and another pair with fledged young along Spring Brook just west of the Robinson property (Figure 9).

Scrub jays are fairly common inhabitants of Gambel oak and pinon/juniper woodlands in western and southern Colorado (Andrews and Righter 1992). They appear to have expanded their range into foothills shrublands of Boulder County during the last 40 years (Boulder County Parks and Open Space 1988). This range expansion may reflect recovery of foothills shrublands from disturbances during the first half of this century, or it may simply reflect the ability of an opportunistic omnivore to expand into semi-urban

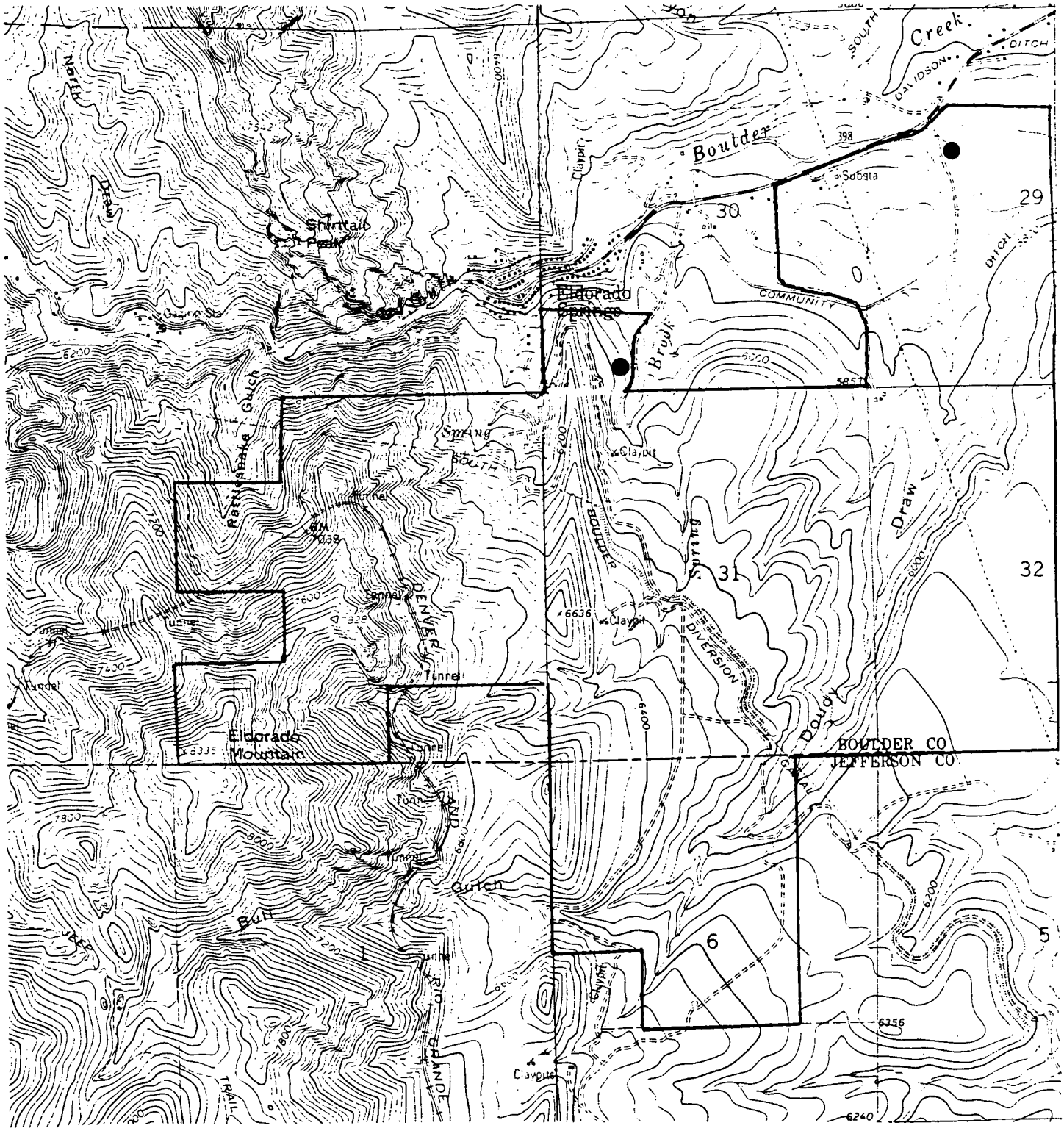

Figure 9. Scrub Jay Sightings

settings. Preservation of dense shrublands within the study area will benefit this species.

American Dipper

Boulder County (Isolated Population, Winter)

I observed an American dipper in the South Boulder Diversion Canal during November, 1992.

Gray Catbird

Boulder County (Isolated Population)

Gray catbirds are uncommon nesters in foothills shrubland (Boulder County Wildlife Inventory, Jones 1989). Numbers have declined since the early twentieth century, when this species was considered common in Boulder County (Henderson, 1908, Betts 1913). I observed three gray catbird nests in upper Doudy Draw during the 1993 breeding season (Figure 10).

In Colorado nesting gray catbirds are confined to two locations: mesic shrublands at the base of the foothills from Fort Collins to Colorado Springs and riparian understory along the South Platte River east of Fort Morgan (Andrews and Righter 1992). Populations are widely scattered. Only 3-5 pairs nested in the Boulder Mountain Park during 1989 (Jones 1989). Preservation of mesic shrublands in Doudy Draw, particularly in the area south of the diversion canal, will benefit this species.

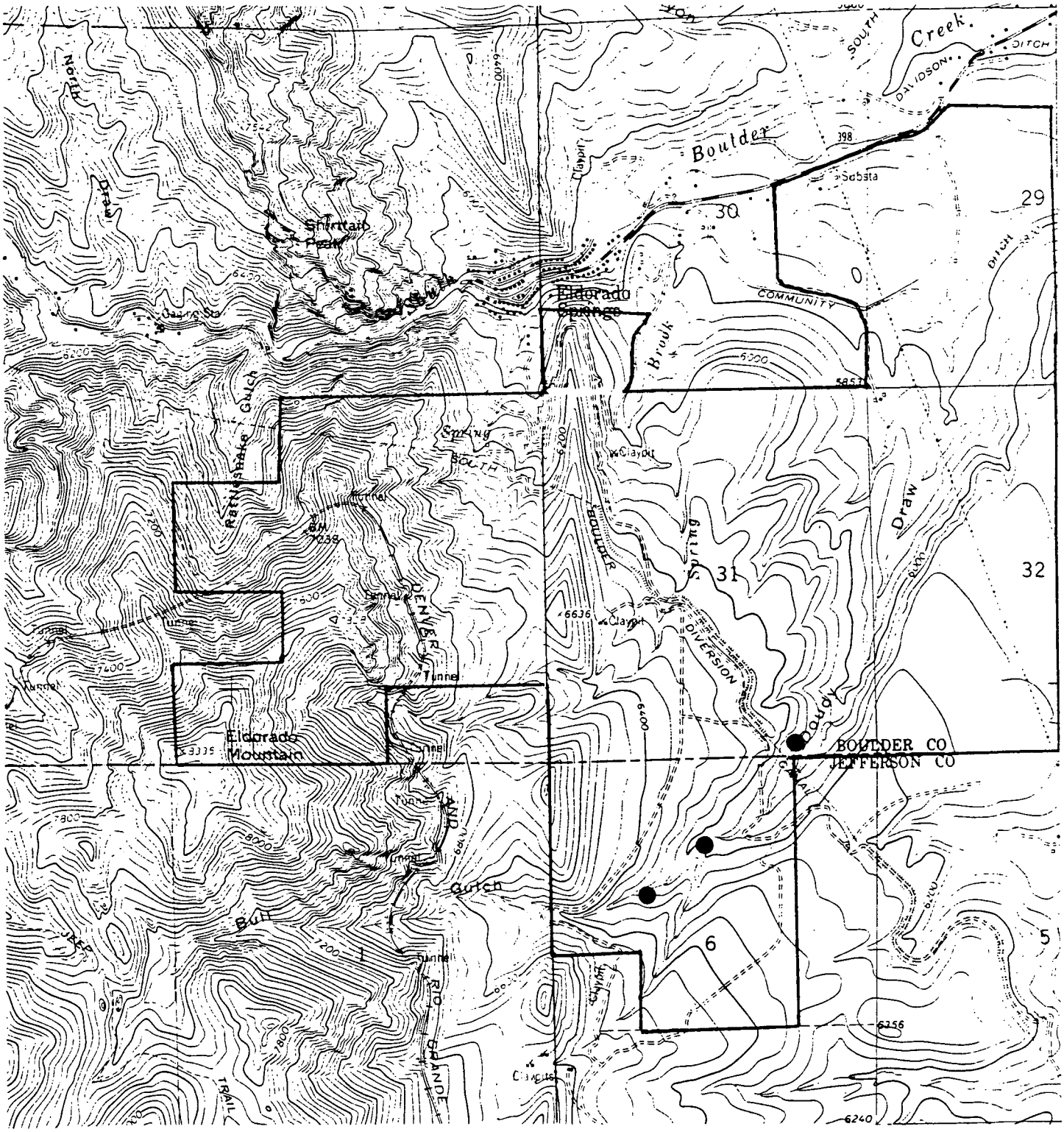

Figure 10. Gray Catbird Nest Sites.

Northern Mockingbird

Boulder County (Rare and Stable)

Northern mockingbirds are considered casual breeders in Boulder County (Boulder County Parks and Open Space 1993). Boulder County is on the edge of the historic range of this species (Andrews and Righter 1992). A northern mockingbird was reported in Doudy Draw on 9 August, 1986 (Boulder County Wildlife Inventory 1975-93). None were sighted within the study area during the 1993 field season.

Sage Thrasher

Boulder County (Rare and Stable, Isolated Population)

Sage thrashers are known to have nested in only two locations in Boulder County, at the National Institute of Science and Technology (Tom VanZandt, pers. comm.) and along Coal Creek east of Highway 93 (Jeff Bachant, pers. comm.). Sage thrashers are commonly seen in Doudy Draw during July and August (Boulder County Wildlife Inventory 1975-93). Some of these birds may be migrants; others may nest in the area.

Sage thrashers nest in sagebrush shrublands in northwestern Colorado, and scattered populations nest in other shrublands in northeastern Colorado (Andrews and Righter 1992). The study area lies on the western edge of this species' range in northeastern Colorado. Additional study is needed to determine this species' nesting habitat requirements in Boulder County.

Cedar Waxwing

Boulder County (Isolated Population)

Andrews and Righter (1992) classified this species as a "rare to uncommon very local summer resident, mostly in lower foothills and adjacent lowlands, but also very locally on eastern plains." I observed cedar waxwings in Doudy Draw and lower Bull Gulch throughout the 1993 breeding season and saw a pair of adults with recently fledged young in Doudy Draw 200 m north of the diversion canal on 29 July (Figure 11).

Cedar waxwings typically nest in conifers or deciduous trees in open woodlands, forest edges, or suburban areas (Ehrlich et al. 1988). Nesting in eastern Colorado is poorly documented (Andrews and Righter 1992). Little is known about their nesting habitat requirements in Boulder County.

Loggerhead Shrike

Federal (Candidate Species)

Boulder County (Rare and Declining)

Loggerhead shrikes are fairly common nesters on the eastern plains of Colorado, but are rare (fewer than three known nesting sites) in Boulder County (Boulder County Comprehensive Plan 1988). A loggerhead shrike was observed within the study area on 24 and 27 August, 1986. None were observed during the 1993 breeding season.

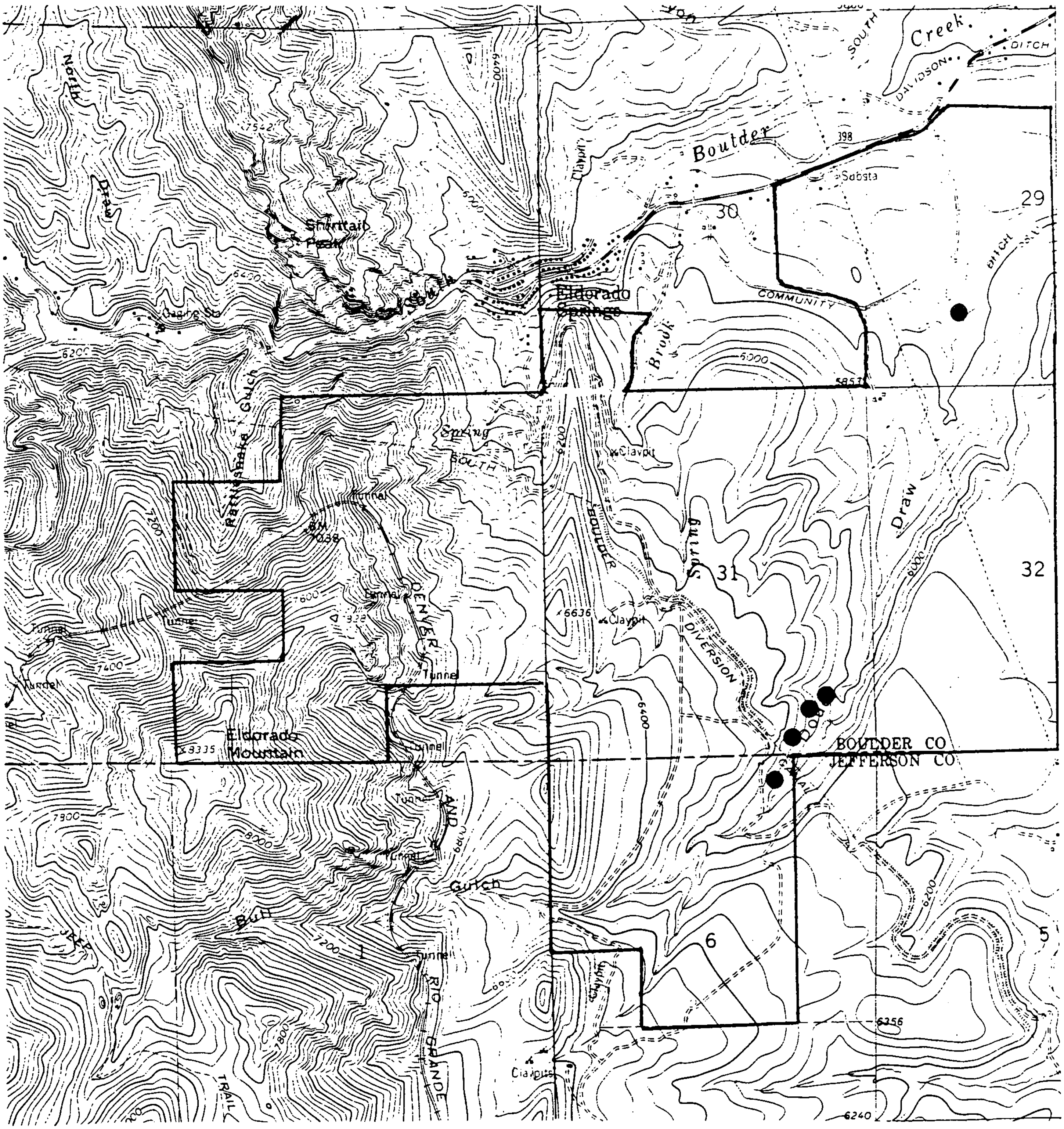

Figure 11. Cedar Waxwing Sightings.

Yellow Warbler

Boulder County (Audubon Blue List)

Yellow warblers are thought to be declining nationally (Tate 1986). Andrews and Righter (1992) classify them as common to fairly common summer residents throughout much of Colorado. Yellow warblers nested in lower Doudy Draw during the 1993 breeding season (Figure 12).

Yellow warblers nest in a variety of settings, including second-growth woodlands, gardens, shrublands, and riparian thickets (Ehrlich et al. 1988). Preservation of cottonwoods, willows, and shrublands in Doudy Draw should benefit this species.

American Redstart

Boulder County (Declining)

This species is considered a rare summer resident in canyons at the base of the eastern foothills of Colorado (Andrews and Righter 1992). Nesting in Boulder County is poorly documented, but this species is thought to be declining (Boulder County Parks and Open Space 1993). A female American redstart was observed in Doudy Draw on 19 May, 1993 (John Tumasonis, pers. comm.).

Blue Grosbeak

State (Undetermined Status)

Blue grosbeaks are fairly common breeders in southeastern Colorado, where they typically nest in scrub oak and piñon-juniper woodlands, but are uncommon to rare in Boulder County (Andrews and

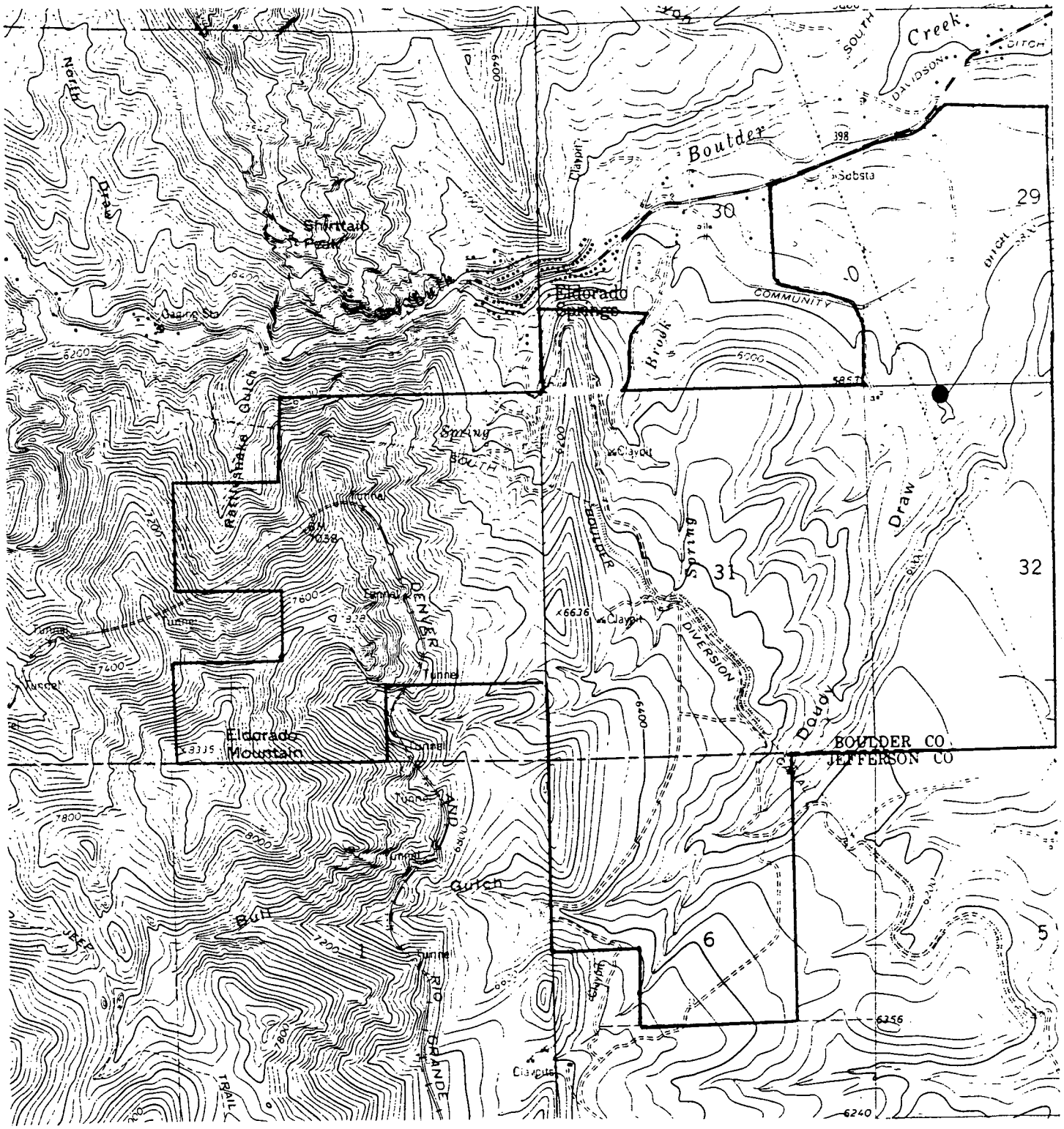

Figure 12. Yellow Warbler Nest Site.

Righter 1992, Boulder County Wildlife Inventory 1975-93). A pair of blue grosbeaks was present in lower Doudy Draw throughout the 1993 breeding season. I observed the female with sticks in her beak on 11 June, 1993 (Figure 13). Preservation of shrublands in lower Doudy Draw should benefit this species.

Lark Bunting

Boulder County (Rare and Declining)

Lark buntings were considered abundant in Boulder County during the early 1900's (Henderson 1908, Betts 1913). Now they are rare breeders in the county (fewer than three known nest sites--Boulder County Parks and Open Space 1993). Lark buntings have been observed within the study area during May and August (Boulder County Wildlife Inventory 1975-93), but none were seen during the 1993 breeding season.

Savannah Sparrow

Boulder County (Isolated Population)

Savannah sparrows nest in wet meadows on the plains, in the foothills, and in the high mountains (Andrews and Righer 1992). I observed a single savannah sparrow in the sedge/cattail wetland along lower Spring Brook on 1 June, 1993.

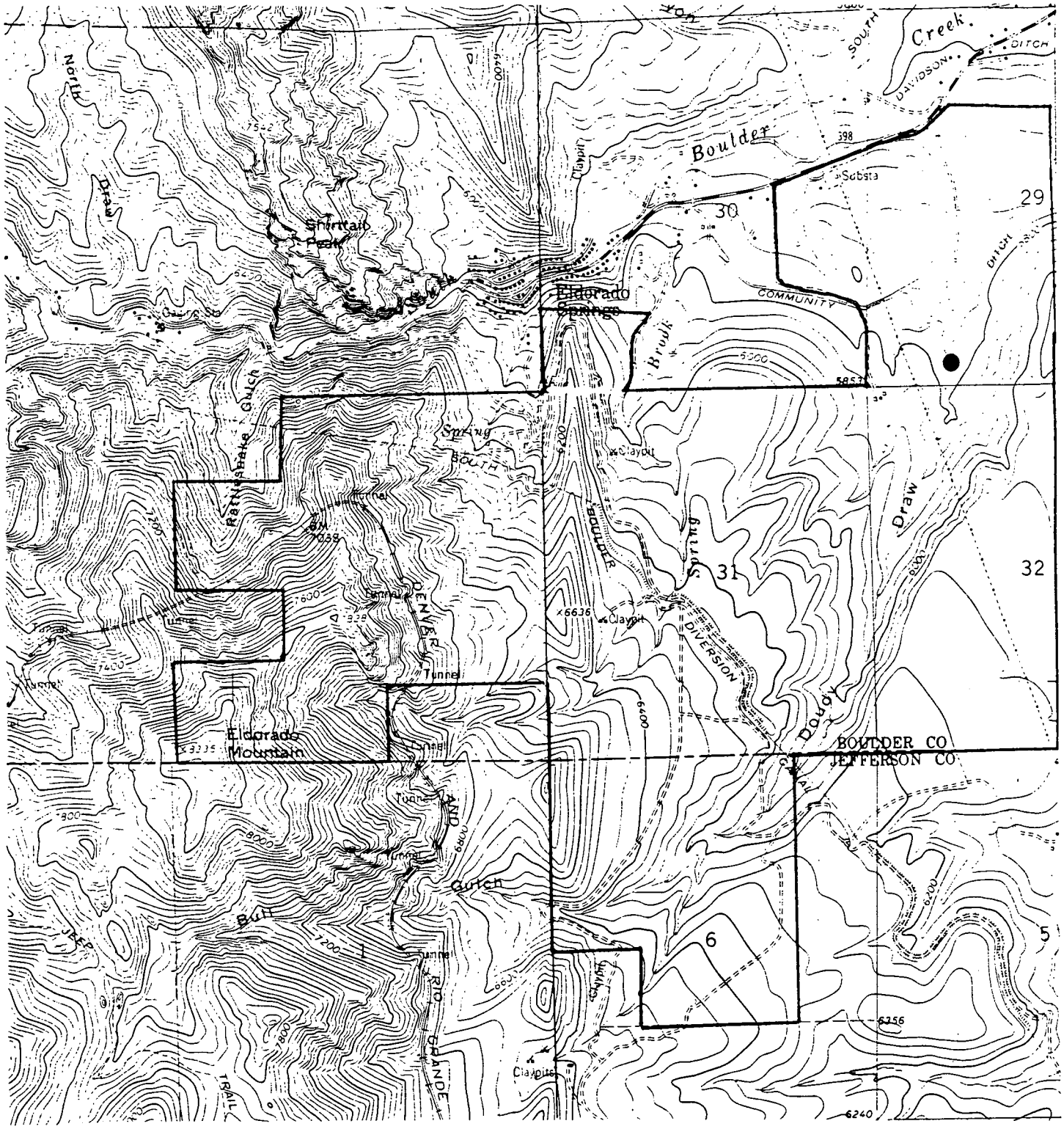

Figure 13. Blue Grosbeak Nest Site.

Grasshopper Sparrow

Boulder County (Audubon Blue List)

Grasshopper sparrows nest in grasslands and in fallow fields throughout central North American (Ehrlich et al. 1988). They are considered uncommon to fairly common breeders on the plains of eastern Colorado (Andrews and Righter 1992). At least one pair of grasshopper sparrows nested in lower Doudy Draw during the 1993 breeding season (Figure 14).

Thompson and Strauch (1986) used variable-line transects to survey grasshopper sparrow populations on City of Boulder Open Space. They estimated the total population at approximately 269 individuals. Their literature survey concluded that grasshopper sparrows normally inhabit open, treeless grasslands with a fairly thick cover of grasses and with taller forbs or shrubs, used as singing perches. They concluded that heavy grazing may reduce grasshopper sparrow habitat, but that there is not enough known about habitat requirements for grasshopper sparrows in western grasslands to determine what changes, if any, should be made in grazing practices in grasshopper sparrow habitat. They recommended continued monitoring of grasshopper sparrow populations along permanent transects on City of Boulder Open Space.

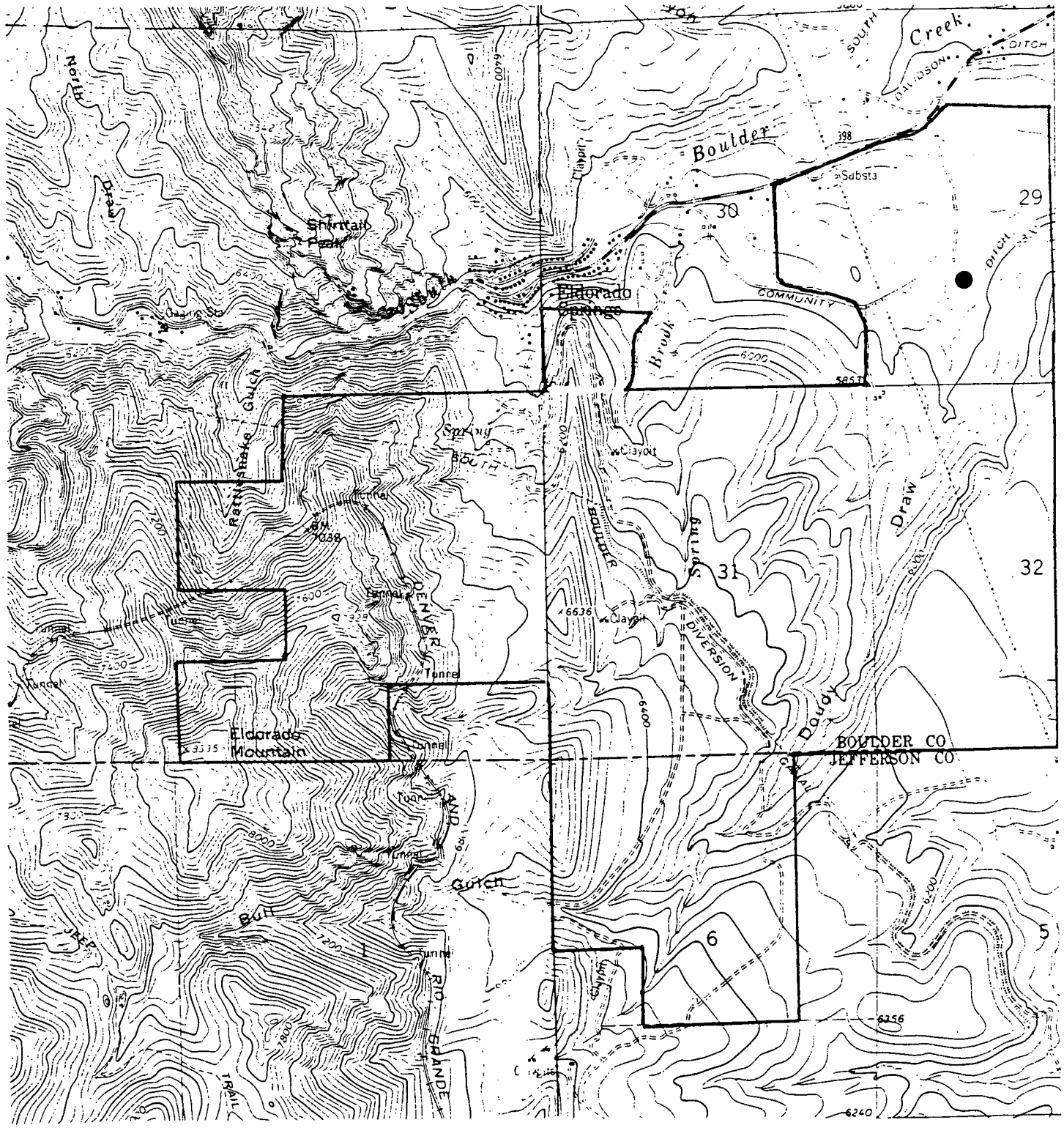

Figure 14. Grasshopper Sparrow Nest Site.

AVIAN HABITATS OF SPECIAL INTEREST

The term "avian habitats of special interest" describes areas that are especially rich in breeding avifauna; exhibit old-growth or climax conditions; or support a complex of isolated, threatened, rare, or endangered species. The approximate extent of these habitats is shown in Figure 15.

Foothills Shrubland

The scattered thickets of chokecherry, hawthorn, three-leaf sumac, wild plum, ninebark, and other mixed shrubs that occur in the lower foothills of Boulder County support a disproportionate percentage of the county's breeding bird population (Boulder County Comprehensive Plan 1988). In the Boulder Mountain Park, foothills shrublands occupy only about 1% of the total land area, yet they have the highest breeding bird densities of any of the park's ecosystems and support eight breeding species that are found nowhere else in the park (Jones 1989).

The foothills shrublands in Doudy Draw are the most extensive representation of this ecosystem within the City of Boulder Mountain Parks and Open Space system. These shrublands cover approximately 40 hectares, or 4% of the study area (extrapolation from aerial photographs). Densest shrub growth occurs in upper Doudy Draw and lower Bull Gulch on either side of the South Boulder Diversion Canal pipeline.

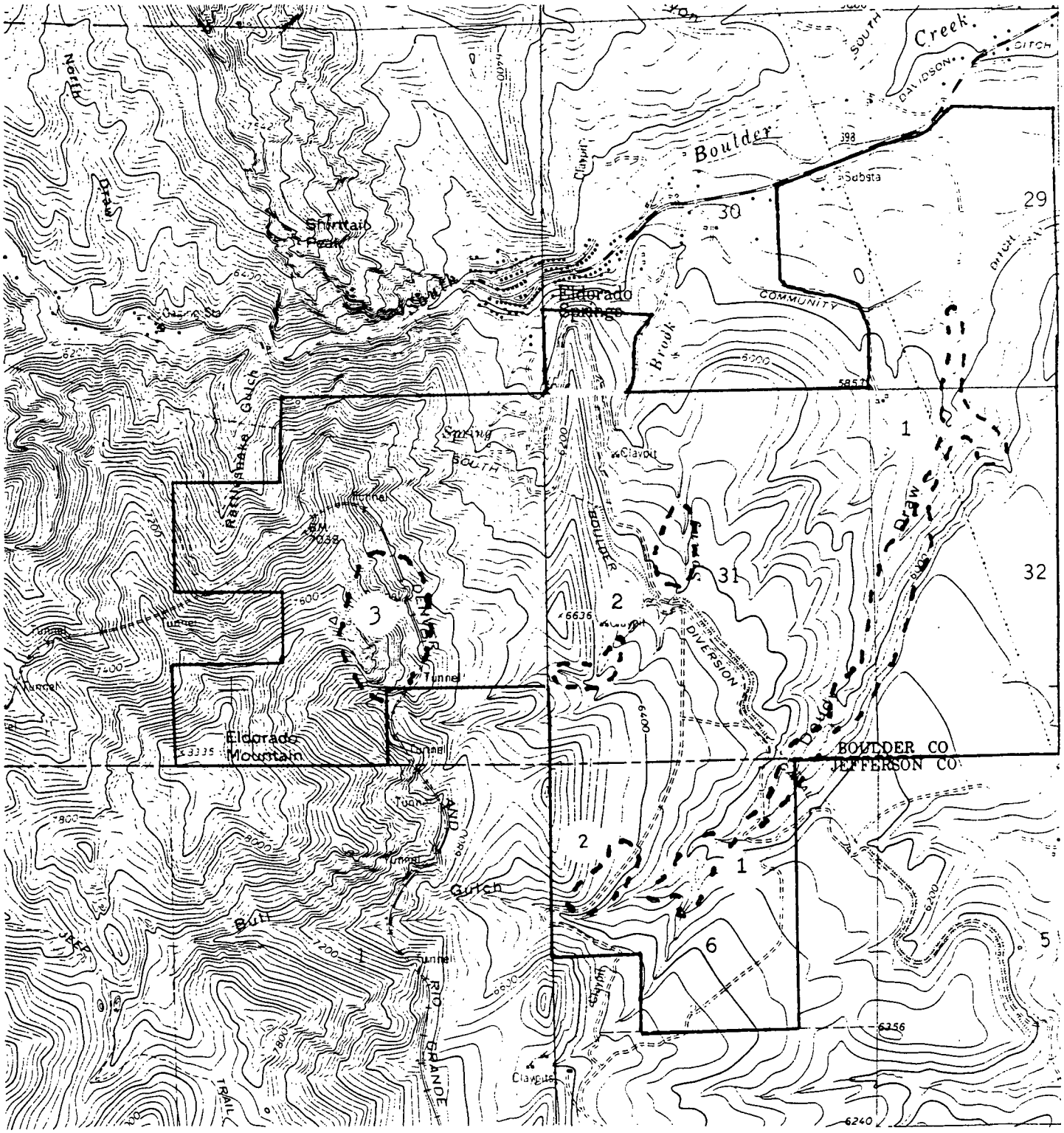

Figure 15. Avian Habitats of Special Interest.

1. Foothills Shrubland
2. Mature Ponderosa Pine Forest
3. Cliffs on Eldorado Mountain

Shrublands in upper Doudy Draw and lower Bull Gulch support a total of 33 breeding bird species, including 9 species of special concern: scrub jay, gray catbird, northern mockingbird, sage thrasher, cedar waxwing, loggerhead shrike, yellow warbler, American redstart and blue grosbeak. Conservation of foothills shrublands is of vital importance to these species of concern, to other shrub-nesting species, and to mammals, including black bears, that forage in this habitat.

Loss of foothills shrubland in Doudy Draw would have an immediate impact on countywide nesting populations of gray catbirds, cedar waxwings, and yellow-breasted chats. The dense, mesic shrublands in upper Doudy Draw, on either side of the diversion canal pipeline, appear to support unusually high densities of nesting gray catbirds and yellow-breasted chats and are one of fewer than five known nesting sites for cedar waxwings in Boulder County (Boulder County Audubon Society 1975-93).

Cattle grazing has had noticeable impacts on shrublands throughout Doudy Draw. On the east side of the Draw, cattle trails have created a terracing effect, and shrub vegetation has been fragmented into small clumps. The mesic shrublands in upper Doudy Draw have also been fragmented by numerous cattle trails. Shrub density appears to have been reduced by trampling or grazing. Chokecherries and hawthornes have taken on a tree-like appearance as their lower branches have been broken away.

Taylor and Littlefield (1986) estimated that 70% to 90% of all natural riparian habitat within the United States has undergone

extensive alteration. They attributed much of this damage to livestock grazing. Their study of shrubland-nesting birds at the Malheur National Wildlife Refuge in southeastern Oregon found that densities of nesting yellow-warblers and willow flycatchers increased dramatically after cattle were removed. Knopf, Sedgwick, and Cannon (1988) observed greatly reduced densities of habitat specialists such as willow flycatcher and Lincoln sparrow in summer-grazed willow shrublands at the Arapahoe National Wildlife Refuge in Colorado. However, Sedgwick and Knopf (1987) concluded that moderate fall grazing (October-November) had little impact on densities of ground and shrub-nesting birds in a cottonwood bottomland in northeastern Colorado. Duff (1979) noted a 350% increase in songbird and raptor use in a Utah riparian community after 8 years of rest from grazing.

Removal of cattle from Doudy Draw should result in an increase in the extent and density of shrub vegetation, reduced streambank erosion, and an increase in species richness and abundance of breeding birds. Maintenance of existing hiking trails, and discouragement, through signage or fencing, of the establishment of "casual" hiking trails in shrub habitat, will also benefit shrub-nesting birds.

Mature Ponderosa Pine Forest Along Spring Brook

Isolated pockets of "near old-growth" ponderosa pine forest occur along Spring Brook, on the mesa between Eldorado Mountain and Doudy Draw. These ponderosa pine stands exhibit many structural

characteristics of old-growth (U.S. Forest Service 1992). They contain a number of trees with diameters greater than 50 cm, large standing dead trees, a multi-layered canopy, and a high percentage of saplings and young trees.

Only about 1% of ponderosa pine forest along the northern Front Range meets U.S. Forest Service specifications for old-growth (Dave Hallock, pers. comm.). Front Range old-growth forests support a number of bird species whose breeding populations appear to be isolated or declining (Tate 1986, Reynolds and Linkhart 1988, Boulder County Parks and Open Space 1993). Old-growth dependent species seen within the study area include northern goshawk (declining locally, forest interior species) northern pygmy owl (cavity-nester), hairy woodpecker (cavity-nester, Blue List), red-breasted nuthatch (cavity-nester, forest interior species), western bluebird (cavity-nester), and hermit thrush (forest interior species).

High snag density is an important component of Front Range old-growth forests (Peet 1988). A density of at least 5 snags/ha is generally recommended for maintaining cavity-nesting bird populations in Rocky Mountain coniferous forests (Balda 1975, Scott 1978, Ffolliot 1983). Snags should be at least 33 cm DBH (Cunningham, Balda, Gaud 1980). Open Space staff may wish to conduct an inventory of snag densities within the study area to determine whether artificial snag creation through girdling or burning is desirable.

Studies conducted in southwestern ponderosa pine forests have suggested that periodic low intensity fires are necessary to create and maintain old-growth ponderosa pine forests (Moir and Dietrich 1988). Little is known about the effects or natural periodicity of low intensity fires in Front Range ponderosa pine forests (Peet 1988). The Open Space staff may wish to investigate the effects of controlled burns on mature ponderosa pine forests within the study area.

Cliffs and Canyons on Eldorado Mountain

Most of Boulder County's breeding population of golden eagles, prairie falcons, and peregrine falcons nest on cliff formations in the lower foothills (Figgs and Lederer 1992). The cliffs on Eldorado Mountain support nesting golden eagles, turkey vultures, red-tailed hawks, prairie falcons, and American kestrels. Cooper's hawks, sharp-shinned hawks, great-horned owls, and northern pygmy owls nest in the canyons that cut through the sedimentary cliffs on Eldorado Mountain. The Mickey Mouse Ears cliff, occupied in 1993 by prairie falcons and common ravens, is a potential nest site for peregrine falcons.

Recreational users of open space probably represent the greatest threat to cliff-nesting raptors on Eldorado Mountain. Continued closure of climbing routes, as necessary, and continued monitoring of active nests will help to protect this resource. Closure signs should be posted at the trailheads as well as on the

cliff faces to encourage compliance by rock climbers and other recreational users.

RECOMMENDATIONS FOR ADDITIONAL RESEARCH

A one season breeding bird census cannot adequately document all of the breeding species present within a given area. In western coniferous forests, breeding bird populations vary from year to year with availability of conifer seeds, insects, and other foods (Balda 1975, Bock 1976). Species that were expected to nest within the study area but were not found during the 1993 breeding season include flammulated owl, eastern screech-owl, northern saw-whet owl, bushtit, mountain bluebird, ovenbird, and indigo bunting.

Quantitative measurements of breeding bird populations within distinct terrestrial habitats will provide a clearer picture of the richness of these habitats. Application of the methodology used by Thompson and Strauch (1986) to census breeding bird populations throughout City of Boulder Open Space will allow meaningful comparisons to be made of breeding bird populations in various habitats. Quantitative measurements of breeding bird populations in the mesic shrublands in upper Doudy Draw and in the "near old-growth" ponderosa pine stands along Spring Brook would be of particular interest.

Annual monitoring of raptor nest sites on Eldorado Mountain is strongly recommended. Observations of prairie falcon nest productivity will help staff to gauge the impacts of recreational users, especially rock climbers, on this species. There is a strong possibility that peregrine falcons will occupy raptor nest sites on Eldorado Mountain in the near future. Continued efforts

should be made to locate an active golden eagle nest in the Eldorado Mountain area. The historic nest site on the Mickey Mouse Ears cliff was last occupied in 1985. Since then, there have been no confirmed observations of golden eagles nesting within the study area.

Volunteers in the Open Space wildlife transect program should be encouraged to report breeding bird observations within the study area. Boulder County Wildlife Inventory Reports from 1975-93 suggest that there may be a number of species, including northern mockingbird, eastern bluebird, and loggerhead shrike, that occasionally nest in Doudy Draw but were undetected during the 1993 breeding season.

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APPENDIX A

BREEDING BIRD CODES

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

Possible

SPECIES OBSERVED or breeding calls heard in suitable nesting habitat.

SINGING MALE present in suitable nesting habitat during breeding season.

Probable

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

PAIR observed in suitable nesting habitat.

TERRITORY presumed through territorial behavior.

COURTSHIP behavior between a male and a female.

AGITATED behavior or anxiety alls of adult.

Confirmed

NEST BUILDING or adult carrying nesting material.

USED NEST or eggshells found.

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

OCCUPIED NEST indicated by adult entering or leaving nest site.

FEEDING YOUNG: adult seen carrying food for young.

NEST WITH EGGS.

NEST WITH YOUNG seen or heard.

NATURAL HERITAGE INVENTORY OF THE MAMMALS OCCURRING IN THE DOUDY DRAW OPEN SPACE, BOULDER AND JEFFERSON COUNTIES, COLORADO

FINAL REPORT

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EXECUTIVE SUMMARY

In 1993, the Colorado Natural Heritage Program (CNHP) was contracted by the City of Boulder Open Space Department to conduct a Natural Heritage Inventory of the mammals occurring in the Doudy Draw area of Boulder and Jefferson Counties. The goals of the inventory were: 1) determine if any rare, threatened, or endangered mammalian species occupied the area, 2) determine if any critical habitats for mammals exist in the area, and 3) determine the mammal species composition of the County's Open Space. During the spring and summer of 1993 we concentrated our efforts on a search for Preble's Jumping Mouse (*Zapus hudsonius preblei*) and associated small mammals species. In addition we collected information on species composition of all habitat types, defined as vegetative cover.

The inventory was conducted in seven steps:

1. A review of aerial photographs, soil surveys, topographic maps, and geological maps.

2. Existing information was gathered, especially literature and Colorado Division of Wildlife data.

3. Areas with suitable habitat to support Preble's Jumping Mouse were selected from information gathered in steps 1 and 2 as well as interviews with experts. All suitable areas were designated as sampling sites, hereinafter called "potential natural areas" (PNAs).

4. Major vegetation types were determined and representative areas were selected as sampling sites.

5. Initial ground-truthing and walk-through surveys were conducted.

6. Systematic trapping and observation was conducted within all designated PNAs and all vegetation types.

7. The results were assimilated into a final report.

Five PNAs and nine major habitat types were identified during the preparatory stages and targeted for sampling. It was determined that the only federally recognized rare mammal species whose range coincided with the study area is *Zapus hudsonius preblei* (Preble's Jumping Mouse). *Z. h. preblei* prefers moist, lowland areas (Armstrong 1972 and personal communication) and preliminary surveys of aerial photos and in the field suggested that the Doudy Draw study area may contain suitable habitat. A recent report of *Z. h. preblei* at nearby Rocky Flats (Stoecker 1992) provided associated plant species to the general habitat description. These associated

plant species were found in most of the PNAs. We sampled for 3,133 trap days (a trap-day is the a 24 hour period for each individual trap). 3,133 trap days in all habitats, however, could not verify the occurrence of Preble's jumping mouse.

Twenty-two mammal species were documented by trapping, direct observation, or observation of various signs (scat, tracks, etc.). All of these species are considered to be relatively common and secure in their range, but their relative densities and the absence of *Z. h. preblei* may be illustrative.

The report includes a single recommendation for the Doudy Draw Open Space:

> Additional inventory/survey efforts in the study area are warranted to adequately understand the composition of the resident mammal populations. This is particularly true for insectivores, bats, and medium-size species and of species at the highest elevations of the area.

INTRODUCTION

In 1993, the Colorado Natural Heritage Program (CNHP) was contracted by the City of Boulder Open Space Department to conduct a mammal inventory of the site of a proposed pump storage facility at Doudy Draw and the surrounding area. The goals of this inventory were: 1) to systematically identify the localities containing rare threatened, or endangered mammals and their critical habitats, and 2) to compile and document a list of mammals occurring in the study area, their relative abundances, and their habitat preferences.

The determination of what occurs within a managed area is of primary importance to its protection and management (Soulé and Kohm 1989). Because this is often a daunting task, a strategic approach which identifies the most sensitive resources within a study area is considered the most prudent tactic. Predictive models of wildlife-habitat relationships are useful with mammalian species and communities (Morrison et al. 1992). Such relationships are the basis for GAP analyses being undertaken in many western states. Armstrong and Freeman (1982) combine the results of previous sampling studies to arrive at a potential mammalian fauna of the Boulder County area. However, the utility of a modeled approach depends on the questions being asked, the scale of the study area, the rarity of the species being studied, and the degree of validation that wildlife-habitat models have undergone (Morrison et al. 1992). Where conservation goals are concerned, the prediction of common species in an area will likely have few negative consequences if in error. However, should areas of small size or rare or endangered species be potentially involved, the potential costs of errors are much higher. In such cases, verification of presence and absence through field work is generally preferred.

The first phase of this inventory has been completed, and the results of it are presented herein. A brief overview of the natural condition of the study area is presented first. The results of the inventory are briefly discussed.

Overview of the Study Area

The study area is restricted to part of the City of Boulder Open Space approximately contained in T1S R70W sec 29,30,31,32; T1S R71W sec 36; and T2S R70W sec 6. These properties contain Doudy Draw and extend west to Eldorado Mountain and south into Jefferson County (**Figure 1**). The study area is approximately 2,000 acres along the foothills of the Southern Rocky Mountains physiographic region. Elevations range from ca. 5,640′ to 8,335′, encompassing portions of the Piedmont and Montane life zones. Boulder and Jefferson Counties, and especially the foothills/prairie ecotone that characterizes the Doudy Draw area, are in general both physiographically and biologically diverse (Mutel and Emerick

1992).

Climate. The climate of the area is varied, being exposed to typical high plains weather but severely modified by the nearby mountains. In general, precipitation here is greater than to the east but less than in the mountains to the west, and temperatures are higher than those either east or west of the Doudy Draw area. Precipitation in nearby Boulder averages 18.5 inches per year with frequent periods of drought in the fall and winter. Average temperatures range from 32.7 F in January to 73.6 F in the summer. Winds in some areas are buffered by the mountains, but at the mouths of the larger canyons can be locally intense and create significant damage (U.S.D.A. 1975).

Soils. The soils of the area are comprised of two types of associations. The mountainous portions to the west are composed of a rock outcrop-Juget-Baller association describable as rock outcrop and shallow, very gravelly and stony soils. The rest of the area is dominated by the Nederland-Valmont association, typified by nearly level to moderately steep, deep, and cobbly soils on old high terraces, alluvial fans, and benches (U.S.D.A. 1975)

Geology. The geology of the area is typical of the boundary between the Front Range (of the Southern Rocky Mountain Province) and the Piedmont area. The foothills along the western edge of the Piedmont are characterized by a series of folded and faulted sedimentary strata, the more resistant beds of which form the striking hogback ridges. East of this margin the area consists of broad, gently sloping surfaces that form steplike levels above modern stream valleys. The high level surfaces of the study area usually occur as fan-shaped pediments mantled by coarse alluvial deposits (U.S.D.A. 1975).

Current Vegetation. The vegetation of the study area is typical of the foothills/prairie ecotone in Boulder County. Coniferous forests dominated by Ponderosa pine are found on the mountainous western portion, and extending eastward on the higher mesas. The cooler microhabitats of north slopes of the mountains are dominated by Douglas-fir. Most of the remainder of the area is covered by grasslands whose pre-settlement composition is unclear but is currently dominated by a wide range of native grasses in some areas, grading into various proportions of introduced grasses and other exotics. The northern slopes of some mesas have patchy to large areas which are shrub-dominated. Riparian areas are dominated by dense shrubs, especially Hawthorne and Coyote willow, with some stands of small Cottonwoods. Wetlands comprise a small but important portion of the study area and are dominated grass/sedge mixtures (Marr 1961). Descriptions of the vegetation are documented in Hogan's (1993) floristic survey of the Boulder Mountain Parks.

Faunal Composition. The fauna of the Doudy Draw area is a

mixture typical of both the foothills of the Southern Rocky Mountains and the western edge of the high plains. Typically, no vertebrates and few invertebrates at the species level are endemic to the area (Andrews and Righter 1992, Ferris and Brown 1981, Woodling 1985, Armstrong 1972, Hammerson 1982, McCafferty et al., 1993, Evans 1988, Kippenhan 1990). Mule deer, Coyotes, and Black bear and a variety of other common species are all well known in the area, as are a large number of breeding passerines and several species of raptors.

Review of mammalogy of the study area. The vicinity of Boulder is known to have high species richness of mammals (Armstrong and Freeman 1982), a fact that is due to a diversity of habitats and to the juxtiposition of two biological regions: the Great Plains and the Southern Rocky Mountains. There are potentially 88 species of mammals that have inhabited the Boulder Mountain Parks area (Armstrong and Freeman 1982). Of these, eight have been extirpated in historic times. In spite of the importance of the area to the understanding of Colorado's natural history, relatively few studies have been undertaken. This is particularly interesting given that several major universities are within an hours drive.

Early mammalogists such as M. Cary (1911) and E. R. Warren (1942) collected specimens from the Boulder area. Although additional information is now available, these early works are still important references. Lechleitner's (1968) semi-technical report on the ecology of Colorado's mammals also considered Boulder County material. Armstrong (1972) reviewed the biogeography and distribution of mammals in Colorado, including all available study material from Boulder County. He noted the significance of the geographic interdigitation of the Piedmont and Front Range habitats to mammalian biogeography.

Armstrong and Freeman (1982) reported on the results of a mammalogy class study that determined the potential mammals of the Boulder Mountain Parks. By incorporating field study and literature reviews, their study provided a relatively thorough review of the mammals of the Boulder vicinity. We note that one of the recommendations of the Armstrong and Freeman study was a call for, "broad baseline research and detailed community- or species-specific studies".

METHODS

We conducted this inventory in six stages:

1. Review aerial photographs. Aerial photographs of the entire survey area were reviewed in detail to identify "potential natural areas" (PNAs) as well as general habitat types to be studied in the following stages. A total of five PNAs were identified based upon

habitat affinities of *Zapus hudsonius preblei*. In addition a qualitative effort identified nine major habitat types that were believed to be significant to mammals. Aerial photographs were compared to topographic maps, wetland maps, soil maps, and geological maps to enhance our ability to detect significant habitats and habitat types.

2. Gather existing information. The mammal collections of the University of Colorado were visited by Natural Heritage scientists where label information from specimens pertaining to the study area was recorded. We reviewed published and unpublished information and included maps, reviewing the Natural Heritage Biological and Conservation Database (BCD) and manual data, and consulting experts.

3. Refinement of PNA numbers and boundaries. From information gathered in steps 1 and 2, map the "potential natural areas" and representative vegetation types with ecosystem boundaries.

4. Perform initial ground surveys. Walk-through surveys were conducted in all habitat types. Most of the Doudy Draw area was hiked over in conducting preliminary inventory and in surveying for mammal species. Particular efforts were made to hike into all major habitat types. We also participated in a group visit to the site by City of Boulder representatives and researchers.

5. Conduct an inventory of the PNAs and identified habitats. Sampling efforts were carried out to determine the presence and status of rare species, the extent of the population (if found), and the area that needs to be protected to preserve the populations. Threats and past or present disturbances are also noted. As part of the comprehensive survey employed by this study, sites representing the best examples of the identified habitats are also inventoried.

The amount of variation within each type was visually assessed and traps were placed at sites that best represented the "typical" composition of the type. Where variation within a type was especially large, such as in the riparian shrub habitat, sampling took place at several sites in hopes of including the range of variation. **Figure 2** shows locations of the sampling sites and **Table 1** lists dominant vegetation at each site. Observations regarding the floral composition were also relevant and recorded.

Field surveys included small mammal trapping and the observations of the animals themselves as well as their various signs. We trapped for 3,133 trap days using mostly Sherman live traps. Sampling sites are indicated in **Figure 1**. At some sites, snap traps and/or the larger sized "rat traps" were used.

Traps were usually set in two parallel rows of 25 traps. Each row

was 10 meters apart and individual traps within the row were placed at 5 meter intervals. In a few areas, traps were placed in a 5 x 5 grid with traps at 10 meter intervals. In a few riparian sites where the riparian vegetation was less than ten meters in width, traps were placed in a single row. Sherman traps were baited with a few rolled oats; snap traps were baited with peanut butter. Traps were checked two times per day. All live specimens were identified and released at the trap site except where laboratory identification was necessary. Voucher material was deposited in the University of Colorado Museum.

At all times in this study, attempts were made to visually identify all mammal species observed. Actual sightings, but also scat and sign, were used to identify mammals. Finally, a bat detector was used to get a preliminary assessment of the bat diversity and density in the area. Sampling sites for the bat detector were ponds and riparian habitats near existing trap sites.

6. Compilation of results and preparation of final report. Results of all mammal sampling are compiled, entered into the Colorado Natural Heritage Program databases, and analyzed. This information is then combined into a report to the contracting agency/organization.

RESULTS

The first phase of the inventory for mammals of the Doudy Draw Open Space is complete. During the 1993 field season (April-October), Natural Heritage staff and volunteers concentrated on completing field surveys of the designated PNAs and the best representatives of each of the described habitats. Although no rare, threatened, endangered, or significant mammalian were found in the Doudy Draw area, a list of mammals found in this study in the study area, and the habitat where each was found, was compiled.

Rare, threatened, or endangered species.

Five rare, threatened, or endangered species were found to potentially occur within the study area: *Zapus hudsonius preblei, Sorex nanus, Sorex merriami, Plecotus townsendii, and Vulpes velox*. All are state rare, but *Zapus hudsonius preblei* and *Vulpes velox* are federal candidates for listing and considered of special concern by the Colorado Division of Wildlife. For the first phase of this inventory, *Zapus hudsonius preblei* was targeted for investigations.

Five areas within the study area were determined to be suitable habitat for *Zapus hudsonius preblei*. The jumping mouse is known from Boulder and Jefferson counties (Armstrong 1972, CDOW unpublished data, U.S.F.W.S unpublished data, Stoecker 1992). The Colorado

Natural Heritage Program currently has historic records of *Z. h. preblei* within the general vicinity of Doudy Draw in its databases, but precise location data is lacking in the source information.

Zapus hudsonius preblei prefers moist, lowland habitats. Warren (1942) describes its habitat as meadows, shrubby fields, edges of wood, and dense vegetation along cold streams. Whitaker (1972) reports this species in moist abandoned fields and along streams, ponds, and marshes with thick vegetation, noting a preference for moist soils. It is believed that *Z. h. preblei* inhabited a former humid grassland and savanna in eastern Colorado, but is now considered a relict of that bygone environment (Armstrong 1972).

Almost the entire length of Doudy Draw along the stream (PNA 1) was identified as likely habitat, as were the less mesic ravines to the west (PNA 2), the two grass/sedge wetlands in the study area (PNAs 3 and 4), and a mixture of grass wetland and riparian shrub along Spring Brook (PNA 5). **Figure 1** illustrates these locations. It was assumed that sampling of these various types of lowland habitat would encompass all possibilities for its occurrence in the area. *Z. h. preblei* was not found in any of the PNAs.

Species composition of Doudy Draw.

Twenty-two species of mammals were captured or observed within the Doudy Draw Open Space. Small mammal trapping for 3,133 trap days resulted in the capture of 348 individuals of ten species. None of the captures or observations were of rare, threatened, or endangered species. No critical habitat was found. Trapping results are summarized in **Table 1.**

We systematically surveyed the major habitat types of the study area to estimate the species composition of the area. Nine distinguishable types were identified: prairie grasslands; foothills meadows (or ecotone); wetlands; riparian shrub; foothills shrub; rocks, cliffs, and talus; ponderosa savanna; ponderosa woodland; and Douglas-fir forest (see the Methods). As an estimate of relative abundance, the number of captures per trap day was computed. The highest observed capture rate was in the foothill shrub habitat followed by the grassland and riparian shrub habitats (**Table 4**). The lowest captures per trap day were in the ponderosa pine sites (woodlands and savanna are combined for analysis) and the ecotone.

The grassland sites exhibited the greatest species richness (for trapped species) with five species. Four species were captured in the riparian shrub and talus habitats, followed by the mixed conifer (n=3), the ecotone, wetlands, foothills shrub, and pine habitats with two species each. However, when trapped and observed species were combined, the three most speciose habitats are riparian shrub (n=10), pine woodland (n=9), and grasslands (n=9).

Peromyscus maniculatus was the most frequently captured species, comprising 80 percent of all captures (**Table 5**). The percentage composition of all other species varied from 0.3-6.0 percent of the total captures.

Table 2 lists all mammal species captured or observed directly or by sign in each habitat type, the relative abundance of trapped animals, the total number of species in each type, and the number of trap days in each habitat. No estimations of relative abundance were made for species that were not trapped. All habitats were dominated by the ubiquitous *Peromyscus maniculatus*. Only in the talus was the abundance of *P. maniculatus* approached by another species, *P. nasutus*.

Bat sampling was restricted to observations except for several forays in late summer using an electronic bat detector. This device uses a sensitive microphone to detect the sounds of an appropriate frequency for bats. The bat sounds are converted into an audible sound for the researcher. Using this device, we determined that there was significant bat activity in the vicinity of ponds and riparian zones. Further survey for bats is warranted and are recommended for phase two of this study.

Species-specific trends.

Table 2 indicates the relative abundances of the small mammal species that were trapped on the Doudy Draw Open Space. *Peromyscus maniculatus* was captured most frequently in the foothills shrub, riparian shrub, and grassland sites. This species was found least frequently in the wetlands sites (a habitat dominated by graminoids). This mouse is a very tolerant species and is often found in high numbers, even in disturbed habitats (Lechleitner 1969). This species is a significant component of the open space ecosystem. It most certainly plays a pivotal role in the food web.

Peromyscus nasutus was found in only three of the habitats of Doudy Draw. The highest relative abundance was revealed in the talus habitat. The species is known to have a preference for this environment. Several individuals were captured in a mixed conifer forest, a habitat not typical for the species. This is explained in that the talus is a type III -- talus that is covered by a nearly closed canopy of trees.

The vole, *Microtus ochrogaster*, was found only in habitats that are dominated by graminoids -- grasslands, wetlands, and meadows (ecotone). Nowhere common, this species was most abundant in the ecotonal meadows.

Perognathus hispidus was captured only four times and only in the grassland habitat. Grasslands are the only suitable habitat for

the species.

Reithrodontomys megalotis was found sparsely in grasslands and in riparian shrub habitats. The single capture of *Zapus princeps* was made in the riparian shrub habitat as were the only captures of *Sorex vagrans*.

In contrast, the Least chipmunk, *Eutamias minimus*, was found only in forested sites at higher elevations. It was most abundant in the mixed conifer forests followed by the talus habitat. Similarly, *Eutamias quadrivittatus* was found locally in the pine forest and on the talus.

Table 1. Summary of the trap sites and results from 3133 total trap nights.

Site no.	Habitat type	Aspect	Dominant Vegetation	Trap Nights	Total Captures
1	Prairie Grassland	0	Stipa sp., other grasses and forbes, Lepidium sp.	100	6 P. maniculatus 2 Perognathus hispidus
2	Prairie Grassland	0	Schizachyrium scoparium, Koeleria macrantha, forbes	100	9 P. maniculatus 1 Perognathus hispidus
3	Prairie Grassland	S	Yucca glauca, Stipa sp., other grasses and forbes	30	3 P. maniculatus 1 Perognathus hispidus
4	Prairie Grassland	E	exotic grasses, sparse Salix exigua and Crataegus sp.	192	34 P. maniculatus 1 P. nasutus 4 Microtus sp. 3 Reithrodontomys megalotis
5	Foothills Meadow	N	Poa spp., forbes	200	3 P. maniculatus 3 Microtus sp.
6	Foothills Meadow	S	Symphoricarpos occidentalis, Poa sp., exotic grasses	25	2 P. maniculatus
7	Wetland	0	Carex spp., grasses	200	1 P. maniculatus 2 Microtus sp.
8	Wetland	N	grasses	250	5 P. maniculatus
9	Wetland	W	Symphoricarpos occidentalis, Carex spp., grasses,	20	0
10	Riparian Shrub	0	Crataegus sp., Toxicodendron rydbergii, grasses	250	25 P. maniculatus 2 Microtus sp. 3 Sorex vagrans
11	Riparian Shrub	0	Crataegus sp., Amorpha fruticosa, grasses	150	14 P. maniculatus
12	Riparian Shrub	0	Crataegus sp., Symphoricarpos occidentalis, grasses	350	58 P. maniculatus 1 Zapus princeps
13	Riparian Shrub	0	Salix exigua, Symphoricarpos occidentalis, grasses	80	8 P. maniculatus

Site No.	Habitat type	Aspect	Dominant Vegetation	Trap Nights	Total Captures
14	Riparian Shrub	0	Crataegus sp., Salix exigua, Symphoricarpos occidentalis, grasses	188	35 P. maniculatus 3 Reithrodontomys megalotis
15	Foothills Shrubland	W	Rhus aromatica, grasses	200	30 P. maniculatus 2 Sylvilagus audubonii.
16	Rocks, Cliffs, Talus	0	lichens, sparse Pinus ponderosa	150	10 P. maniculatus 13 P. nasutus 4 Eutamias minimus
17	Rocks, Cliffs, Talus	E	lichens	105	7 P. maniculatus 2 P. nasutus 2 Eutamias minimus
18	Rocks, Cliffs, Talus	E	lichens, sparse Sabina scopulorum	10	1 Eutamias quadrivittatus
19	Rocks, Cliffs, Talus	S	lichens, sparse Pinus ponderosa	20	1 P. maniculatus 1 P. nasutus 2 Eutamias quadrivittatus
20	Ponderosa Savanna	0	Pinus ponderosa, grasses	150	3 P. maniculatus 1 Eutamias minimus
21	Ponderosa Woodland	0	Pinus ponderosa, grasses	100	0
22	Ponderosa Woodland	0	Pinus ponderosa, sparse Crataegus sp. and Pseudotsuga menziesii, grasses	60	4 P. maniculatus 3 Eutamias quadrivittatus
23	Douglas-fir Forest	E	Pseudotsuga menziesii, Mahonia repens	200	19 P. maniculatus 4 P. nasutus 10 Eutamias minimus

Table 2. Mammal species captured (X),observed (O), or leaving sign (S) and associated habitats in Doudy Draw, Boulder and Jefferson Counties, Colorado. Numbers in parentheses represent relative abundances (captures/trap nights).

	Prairie Grasslands	Foothills Meadows	Wetlands	Riparian shrub	Foothills shrubland	Rocks, Cliffs, Talus	Ponderosa Savanna	Ponderosa Woodland	Douglas-fir Forest
Sorex vagrans				X (0.003)					
Vespertilionid sp.		O		O,S (pond)					
Sylvilagus audubonii				O,S	X,O,S (0.013)				
Peromyscus maniculatus	X (0.120)	X (0.022)	X (0.013)	X (0.138)	X (0.150)	X (0.063)	X (0.020)	X (0.031)	X (0.095)
Peromyscus nasutus	X (0.002)					X (0.056)			X (0.020)
Microtus ochrogaster	X,S (0.009)	X (0.013)	X (0.004)						
Perognathus hispidus	X (0.009)								
Reithrodontomys megalotis	X (0.007)			X (0.003)					
Zapus princeps				X (0.001)					
Eutamias minimus						X,O (0.025)	X (0.007)		X,O (0.049)
Eutamias quadrivittatus						X,O (0.007)		X,O (0.019)	
Tamiasciurus hudsonicus									O,S
Spermophilus variegatus						O			
Marmota flaviventris						O			
Sciurus aberti								O	

	Prairie Grasslands	Foothills Meadows	Wetlands	Riparian shrub	Foothills shrubland	Rocks, Cliffs, Talus	Ponderosa Savanna	Ponderosa Woodland	Douglas-fir Forest
Thomomys talpoides	S			S					
Ondatra zibethicus			S						
Mustelid sp.								S	
Canis latrans	O,S	S		O	O		S	S	000
Ursus americanus	S	S		S				S	S
Felis concolor								S	
Procyon lotor	S			S				S	
Odocoileus hemionus	O,S	O,S	S	S	O,S		S	O,S	O,S
NUMBER OF SPECIES TOTAL = 23	9	6	4	10	4	6	4	9	6
TRAP NIGHTS TOTAL = 3133	422	225	470	1018	200	285	150	160	203

Table 3. Small mammal captures in eight sampled habitats in the Doudy Draw study area.

HABITAT/VEGETATION TYPE	CAPTURES	TRAP DAYS	CAPTURES/ TRAP DAY
Grassland	64	422	0.152
Ecotone	8	225	0.036
Wetland	8	470	0.017
Riparian shrub	149	1018	0.146
Foothills shrub	32	200	0.160
Talus	43	285	0.151
Pine	11	310	0.035
Mixed conifer	33	203	0.163
TOTAL	348	3133	0.111

Table 4. Species composition of total small mammal captures in the Doudy Draw study area.

SPECIES	CAPTURES	% TOTAL CAPTURES	CAPTURES/ TRAP DAY
Sorex monticolous	3	0.9	0.001
Peromyscus maniculatus	277	79.6	0.088
Peromyscus nasutus	21	6.0	0.007
Perognathus hispidus	4	1.1	0.001
Microtus ochrogaster	11	3.2	0.003
Reithrodontomy megalotis	6	1.7	0.002
Eutamias quadrivittatus	6	1.7	0.002
Eutamias minimus	17	4.9	0.005
Zapus princeps	1	0.3	0.0003
Sylvilagus audubonii	2	0.6	0.0006

DISCUSSION

Armstrong and Freeman (1982) suggested that 88 species of mammals occurred in historical times within the area of the Boulder Mountain Parks. Of these, 8 have been extirpated in the county. Of the remaining species, approximately 60 species are likely to be found in the vicinity of the Doudy Draw Open Space parcel Armstrong and Freeman (1982). We captured or observed only 23 species after 3,133 trap days and many field days of observations. This is approximately 37% of the possible total according to Armstrong and Freeman. That more species were not located in this study was not surprising since bats, medium-sized mammals, and shrews were susceptible to observation or trapping methods.

All of the species observed or captured were expected. Most are common in the area (e.g. Abert's squirrels, Deer mouse, Mule deer). Others are less well known (e.g. Hispid's pocket mouse, Western harvest mouse). A rare species known to occur in the County, Preble's jumping mouse, was not captured or observed. Although apparently suitable habitat is present on the Open Space parcel, heavy trapping did not reveal *Zapus hudsonius preblei*.

Some of the habitats of Doudy Draw are similar or the same as those of the Rocky Flats area (Jefferson County) and only a short straight-line distance away. *Zapus hudsonius preblei* is known to occur at Rocky Flats and at lower elevations within the Boulder Creek drainage of Boulder (Stoecker 1992, Armstrong, pers. comm.). There are several reasons that the Jumping mouse may not have been captured in the Doudy Draw study area. First, *Zapus* may have been eliminated from the area at some earlier time and has not yet reinvaded. Second, the habitat may not be suitable (it is somewhat higher in elevation). Finally, the jumping mouse may occur at the site, but was simply not taken. We feel that the trapping effort was conducted in the most suitable habitats for *Zapus hudsonius*. We also feel that the trapping effort was sufficient to determine if *Zapus* occurred on the site.

Although few comparable studies have been conducted in the foothills of Boulder County, Armstrong and Freeman (1982) reported on trapping results in the same habitats on the north side of South Boulder Creek. **Table 5** compares the results of their trapping and ours. We collected ten species in the study area while Armstrong and Freeman reported seven species.

As in the present study, *Peromyscus maniculatus* dominated the trapping results of the 1982 survey. Interestingly, the former study reported captures of *Microtus pennsylvanicus* and *Neotoma mexicanus*. Neither of these species were observed in our study. Similarly, we captured *Sorex monticolous, Reithrodontomys megalotis, Sylvilagus audubonii*, and two species of *Eutamias*. Since similar trapping methods were used in both studies, we suspect that trap placement (microhabitat selection), trapping tenure, and variations in population abundance explain the differences observed.

Of interest is the capture, in 1982, of *Peromyscus nasutus* in the plains riparian habitat. Extensive trapping in this habitat in the Doudy Draw area did not result in captures of *P. nasutus*. Sixteen percent of the Armstrong and Freeman (1982) captures were of this species. Whereas there could be significant population

fluctuations in the area in the years 1982 and 1993, we suspect that the plains riparian site(s) surveyed by Armstrong and Freeman (1982) were along South Boulder Creek. Due to the dynamic history of that stream, the banks of the creek have crevices, boulders, and some vegetation that structurally resemble talus habitat. In contrast, our sampling sites in riparian shrub areas did not have boulders and large trees.

Table 5. A comparison of the trapping results of Armstrong and Freeman (1982) and this study. We have considered all of their results except those from aspen woodlands. Significant stands of aspen were not sampled in the 1993 survey. The former efforts were conducted a few miles north and in similar habitats.

SPECIES	1993 CAPTURES	% 1993 CAPTURES	1982 CAPTURES	% 1982 CAPTURES
Sorex monticolous	3	0.9	-	-
Peromyscus maniculatus	277	79.6	136	74.3
Peromyscus nasutus	21	6.0	30	16.4
Perognathus hispidus	4	1.1	1	0.5
Neotoma mexicanus	-	-	7	3.8
Microtus pennsylvanicus	-	-	1	0.5
Microtus ochrogaster	11	3.2	8	4.4
Reithrodontomys megalotis	6	1.7	-	-
Eutamias quadrivittatus	6	1.7	-	-
Eutamias minimus	17	4.9	-	-
Zapus princeps	1	0.3	-	-
Sylvilagus audubonii	2	0.6	-	-

Status of the mammalian fauna.

Historical and present land use at Doudy Draw has significantly altered the landscape. Visible impacts include the diversion and impoundment of water sources for both urban and livestock uses, mining activity at several sites, fragmentation of continuous habitat by roads, construction of a power line and the associated reseeding, and the maintenance of livestock that results in the trampling of lowlands and the alteration of native plant communities. The extensive use of the City of Boulder Open Space almost certainly has demonstrable effects on the behavior and perhaps the habitats of the mammal species that inhabit the area. The effects of such alterations and circumstances on the mammalian fauna are not clear, but the results of this study should be interpreted with past and present disturbances in mind. It is likely that the composition of species differs in substantial ways from pre-historic times (Armstrong 1972).

The observed mammalian diversity at Doudy Draw was less than anticipated. Armstrong and Freeman (1982) used observed and predicted data to estimate that 88 species of mammals occurred within Boulder Mountain Parks. Of these, 8 have been extirpated in historic times. We positively identified twenty-two species as occurring in the area. Some of this variance is no doubt explained by sampling methods used. The methods were selected to optimize the capture of small mammals, targeting *Zapus hudsonius preblei*, at the same time excluding some very small (shrews) as well as medium and large mammal species. Other species are secretive enough to go unnoticed even by trained observers. The habitats available in the Doudy Draw area are not as broad as are found in the entire Boulder Mountain Parks, partially accounting for the reduced number of species we observed. Almost no effort was made to capture bats in the Doudy Draw area; although, bats were observed. We did use a bat detector to determine areas of highest potential for additional work. Identifying the shrews and bats that potentially inhabit the area could add an additional 14 species to the known fauna.

In conclusion, we did not locate any rare, threatened, or endangered mammal species on the Doudy Draw Open Space. We did identify 23 species within the ecosystem. Ten of these species were captured in small mammal traps. *Peromyscus maniculatus* dominated the observed mammals with nearly 80% of all captures. Armstrong and Freeman (1982) suggest that 88 mammal species could have occurred in the area of Boulder Mountain Parks. Although Doudy Draw has a somewhat more restricted area, at least 60 species may occur in the study area. Therefore, approximately 37% of the fauna is confirmed by way of this study. Additional efforts are needed to identify the remaining components of the fauna. Particular emphasis should be placed on surveys for bats, shrews, and medium-sized species such as weasels, skunks, and canids. Finally, although eight species that once occurred in the foothills of Boulder County no longer are extant, the mammalian species remain diverse. We found no evidence, in this partial survey, that the species composition was grossly altered. Continued surveys will providing additional needed information.

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Volunteers of the Colorado Natural Heritage Program who cheerfully provided invaluable help included: Christine Carcano who organized and conducted extensive field work, Sarah Brandt, Sandra Cross, Alissa Salmore, Matt Sura, and Todd Wright.

FIGURE 1. Map of Doudy Draw study area and PNAs.

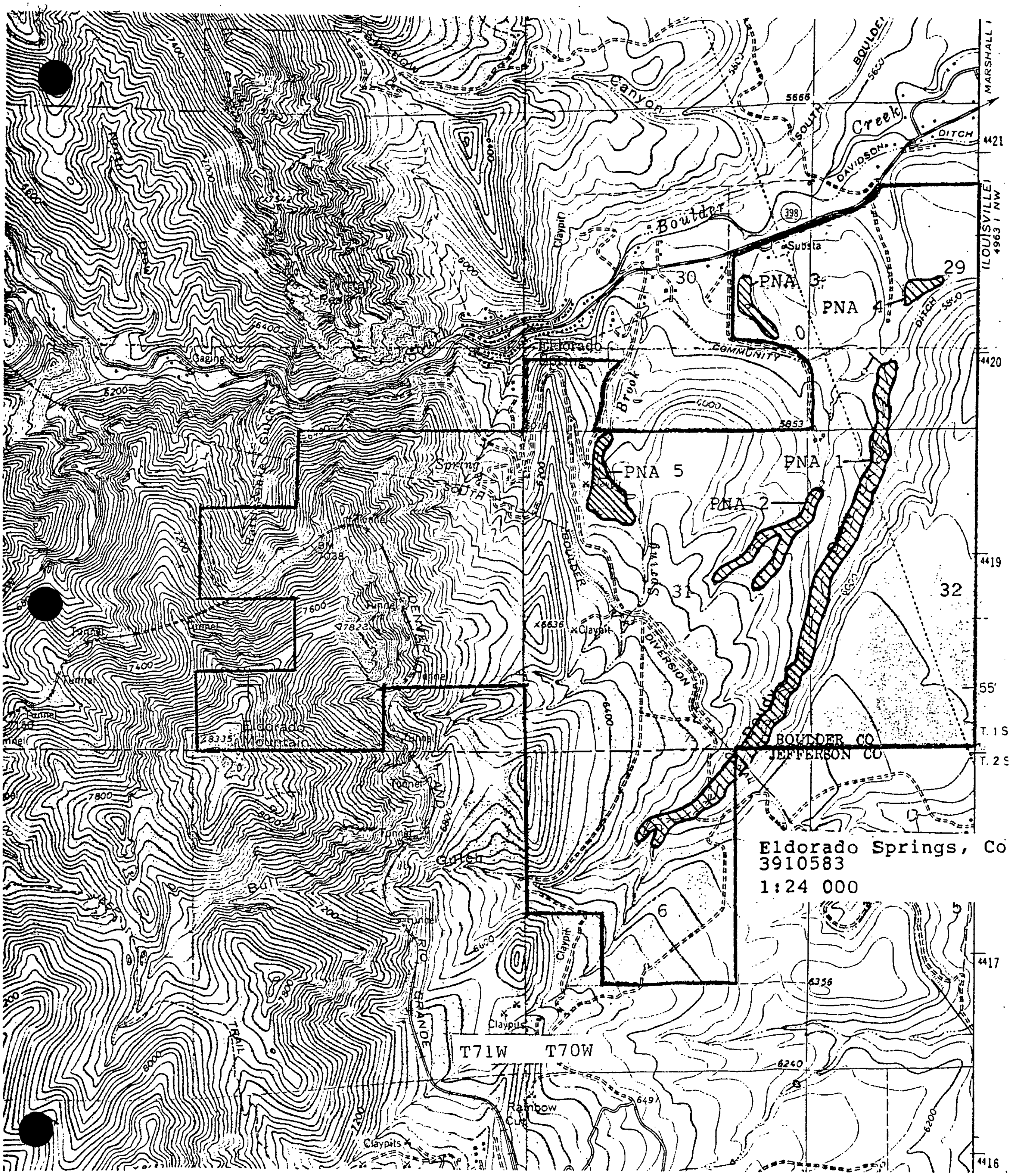
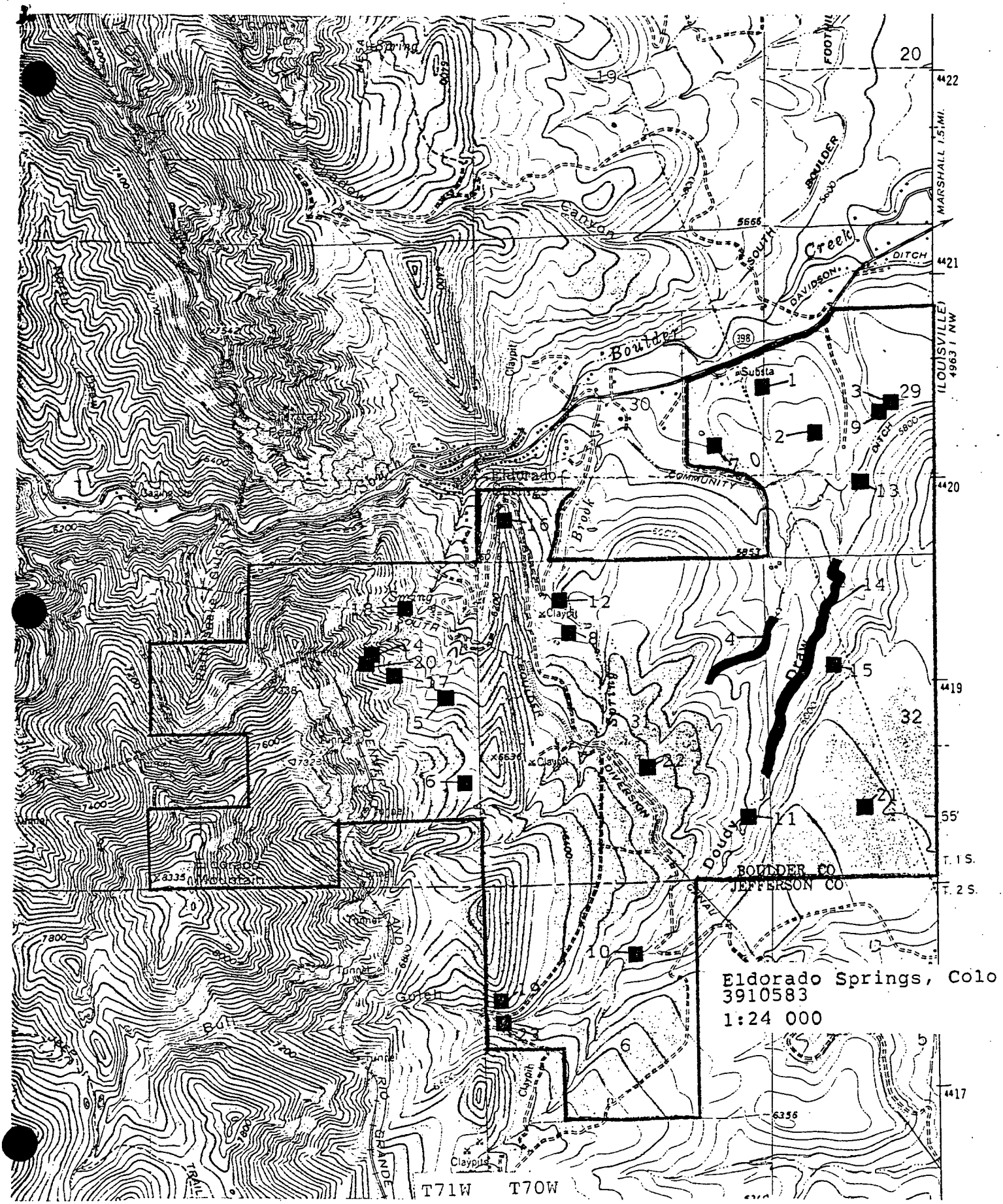


Figure 2. Map of Doudy Draw sample sites.



NATURAL HERITAGE INVENTORY OF THE RARE PLANTS AND SIGNIFICANT NATURAL COMMUNITIES OF THE DOUDY DRAW AND ELDORADO MOUNTAIN AREA, COLORADO

FINAL REPORT

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EXECUTIVE SUMMARY

In 1993, the Colorado Natural Heritage Program (CNHP) was contracted by the City of Boulder Open Space Department to conduct an inventory of Open Space property in the Doudy Draw/Eldorado Mountain area. The objective of the study was to conduct a systematic botanical inventory of the area, concentrating on rare, threatened, endangered, or sensitive species and significant natural communities/plant associations monitored by CNHP for their biodiversity significance. In short, we were to identify those sites supporting unique or exemplary natural communities, rare plants, and other significant natural features. The inventory was conducted in five steps.

1. Review topographic maps and available aerial photographs.

2. Gather existing information.

3. Perform initial ground surveys.

4. Inventory the entire study area.

5. Compile results and prepare the final report.

Several rare plant populations were located within the study area including: *Spiranthes diluvialis* (1 population), *Viola pedatifida* (2 populations), *Amorpha nana* (2 populations), *Asplenium septentrionale* (2 populations), and *Smilax lasioneuron* (1 population).

RECOMMENDATIONS

1. Continue inventory for rare species and establish monitoring programs on those rare plant populations identified in this study.

2. Investigate the possibility of restoration of natural communities.

3. Expand public awareness of the need for protecting areas determined to be significant to natural diversity.

4. Proactively plan future development to minimize impacts to natural heritage resources.

INTRODUCTION

In 1993, the Colorado Natural Heritage Program (CNHP) was contracted by the City of Boulder Open Space Department to conduct an inventory of Open Space property in the Doudy Draw/Eldorado Mountain area. The objective of the study was to conduct a systematic botanical inventory of the area, concentrating on rare, threatened, endangered, or sensitive species and significant natural communities/plant associations monitored by CNHP for their biodiversity significance. In short, we were to identify those sites supporting unique or exemplary natural communities, rare plants, and other significant natural features.

This inventory has been completed, and the results of it are presented herein. A brief overview of the natural condition of the study area is presented first. The results of the inventory are discussed with emphasis on the areas of biodiversity significance identified during this study.

Overview of the Study Area

The study area is a part of the City of Boulder Open Space properties containing Doudy Draw and extending west to Eldorado Mountain (**Figure** 1). The site is mapped on the Eldorado Springs U.S.G.S. Quadrangle, and includes the following: T2S, R70W, section 6; T1S, R70W, all of section 31, most of the west half of sections 29 and 32, and parts of section 30 south of Highway 170; T1S, R71W, most of section 36 (unsurveyed). The study area is approximately 2,000 acres in size and is located along the foothills of the Southern Rocky Mountains physiographic region. Elevations range from ca. 5,640' to 8,335', which includes the Piedmont and Montane life zones (U.S.D.A. 1975). Boulder County, and especially the foothills/prairie ecotone that characterizes the Doudy Draw area, are physiographically and biologically diverse.

Climate. The climate of the area is varied, being exposed to typical high plains weather, but significantly modified by the nearby mountains. In general, precipitation here is greater than to the east but less than in the mountains to the west, and year round temperatures are higher than those either east or west of the study area. Precipitation in nearby Boulder averages 18.52 inches per year with frequent periods of drought in the fall and winter. Average temperatures range from 32.7 degrees Fahrenheit in January to 73.6 degrees in July. Winds at the mouths of the larger canyons can be locally intense (U.S.D.A. 1975).

Soils. The soils of the area are of two associations. The mountainous portions to the west are composed of a rock outcrop-Juget-Baller association described as rock outcrop and shallow, very gravelly and stony soils formed in residuum from granite and sandstone. The rest of the area is dominated by the Nederland-Valmont association, typified by nearly level to moderately steep, deep, and cobbly soils on old high terraces, alluvial fans, and benches formed in gravelly and cobbly alluvium (U.S.D.A. 1975).

Geology. The geology of the area is typical of the boundary between the Front Range and the Piedmont area. The foothills along the western edge of the Piedmont are characterized by a series of folded and faulted sedimentary strata, the more resistant beds of which form the striking hogback ridges. East of this margin the area consists of broad, gently sloping surfaces that form steplike levels above modern stream valleys. The high level surfaces of the study area usually occur as fan-shaped pediments mantled by coarse alluvial deposits (U.S.D.A. 1975).

Current Vegetation. The vegetation of the study area is typical of the foothills/prairie ecotone in Boulder County. Coniferous forests and woodlands of *Pinus ponderosa* (ponderosa pine) dominate the mountainous western portion and extend eastward on the higher mesas. Cooler (generally north facing) slopes and microhabitats support mostly *Pseudotsuga menziesii* (Douglas-fir) forests (Marr 1961). Most of the remaining area is covered by a grassland whose pre-settlement composition is unclear but is currently dominated by a wide range of native grasses in some areas, grading into various proportions of introduced grasses and forbs. Riparian areas are dominated by dense shrubs, especially *Crataegus macracantha* (hawthorn) and various *Salix* species (willows), with some stands of small *Populus* species (cottonwoods). Wetlands comprise a small but important portion of the study area and are dominated by a grass/sedge mixtures.

Faunal Composition. The fauna of the Doudy Draw area is a mixture typical of both the foothills of the Southern Rocky Mountains and the western edge of the high plains. Typically, no vertebrates and few invertebrates at the species level are known to be endemic to the area (Andrews and Righter 1992, Ferris and Brown 1981, Woodling 1985, Armstrong 1972, Hammerson 1982, McCafferty et al., 1993, Evans 1988, Kippenhan 1990). Mule deer, coyotes, and black bear are all well known in the area, as are a large number of breeding passerines and several species of raptors.

METHODS

Natural Heritage staff initiated prioritized inventories in order to gather information on Colorado's rare species and natural communities in a more thorough and systematic manner. Given that some regions of the state face greater development pressures than others, Natural Heritage staff and network scientists are attempting to inventory the most highly threatened areas first. The Doudy Draw/Eldorado Mountain property is potentially one of these areas. The inventory was conducted in five stages:

1. Review topographic maps and available aerial photographs.

2. Gather existing information.
   No known occurrences of rare plants or significant natural communities were found in the CNHP Biological and Conservation Databases (BCD) from within the study area, but there were several known occurrences from nearby areas and

these species (listed below) were searched for in appropriate habitats on the Open Space property.

Asplenium septentrionale
Botrypus virginiana
Carex torreyi
Carex saximontana
Lilium philadelphicum
Listera convallarioides
Malaxis brachypoda
Pyrola picta
Selaginella weatherbiana
Smilax lasioneuron
Spiranthes diluvialis
Viola pedatifida
Woodsia mexicana

3. Perform initial ground surveys.
One day was spent with Open Space staff to become more familiar with access points and the landscape. Familiarity with the area allowed the field scientists to plan efficient field visits.

4. Inventory the entire study area.
Tim Hogan and Nan Lederer visited the site 20 times throughout the summer to locate species with different phenologies. Areas with potential habitat for rare species were surveyed at the times when the specific plant would be most conspicuous (usually flowering). At this time detailed information was collected on the presence and status (population size, habitat information, landform, associated species, etc.) of rare species. Threats and past or present disturbances were also noted.

5. Compile results and prepare the final report.
As fieldwork was completed, Natural Heritage staff scientists reviewed the information gathered. For locations of rare plant populations or significant communities (element occurrences) found to be of statewide significance, these data are transcribed onto Natural Heritage Program maps and entered into the BCD.

RESULTS

Flora:

Four hundred and twenty eight species of vascular plants were identified by Tim Hogan and Nan Lederer. Four of these species are monitored by CNHP. Included were

302 genera in 92 families. Families represented most commonly were Asteraceae (70 species), Poaceae (52 species), Fabaceae (26 species), Rosaceae (19 species), and Brassicaceae (18 species). Approximately 19% of the species were adventives (83 species). A full species list is included in the appendices. Approximately 50 voucher specimens were collected and placed in the University of Colorado Herbarium (COLO). Voucher specimens were collected only for those species not well documented from the general area or where needed to confirm identification.

In the nearby Boulder Mountain Park 639 species were documented in three years of field work by Hogan (1993). The Doudy Draw/Eldorado Mountain area is only about 1/3 the size of the Boulder Mountain Park, yet 428 species were found in one field season of work. This high diversity is in part because of the location of the study site on the foothills/prairie ecotone.

Rare Plants

Tim Hogan relocated a small population of *Spiranthes diluvialis* (Ute ladies'-tresses, G2/S1/LT) within the study area. This plant is listed as threatened by the U.S. Fish and Wildlife Service (USF&WS) under the Endangered Species Act. This population was located at 5760' elevation (T1S, R70W, the center of section 29), along the drier margins of a swale which is kept moist by seepage from a nearby irrigation ditch. On August 8, 1993, when the population was located, there were 4 individuals (1 in bud, 1 in fruit, and 2 in flower). Associated species were *Agrostis gigantea* (redtop), *Juncus arcticus* (rush), *J. saximontana* (rush), *Carex nebrascensis* (Nebraska sedge), *Schoenoplectus pungens* (bulrush), *Lycopus americanus* (water horehound), *Cichorium intybus* (chicory), and *Cirsium arvense* (Canada thistle). Total graminoid cover was 80%, and total forb cover was 20%. Potential threats that need to be investigated are grazing effects, changes in the groundwater hydrology, and invasion of Canadian thistle. Documentation to meet the *S. diluvialis* survey requirements has been forwarded to the Grand Junction office of the USF&WS. Areas surveyed for the species are marked on the occurrence map included in the appendices (Tim Hogan and Nan Lederer are certified *S. diluvialis* surveyors). It is recommended that a management plan be developed specifically for the population. Also, a monitoring program for this population would be recommended to determine the long term viability of the population.

Viola pedatifida (birdfoot violet, G5/S2) was also found on the study area. Two sub-populations were found within about 1/2 mile of each other with a total of about 120 individuals. More detailed information is included on the completed survey forms included in the appendices. It is recommended that a management plan be developed specifically for these populations.

Two sub-populations of *Amorpha nana* (dwarf wild indigo, G5/S?) were found within the study area. A total of six individuals were seen in the two sub-populations. Grazing impacts on this species are unknown. More detailed information is included on

the survey forms included in the appendices. This information will help to determine the rarity of this species, which seems to be more common than previously thought.

Several populations of *Asplenium septentrionale* (grass fern, G3/S2) were found within the study area. Individuals were not specifically counted, but it was noted that there were several individuals in each population. No threats were perceived for these populations. This species appears to be more common than previously known and doesn't appear to be threatened in Colorado. The species' rarity rank may be down graded in the future.

One population of *Smilax lasioneuron* (carrion flower) was located within the study area. It was estimated that there were 5 individuals in this population. This species is no longer actively monitored by CNHP.

Natural Communities:

No rare or exemplary natural communities monitored by CNHP or listed in the Boulder County Comprehensive Plan were located within the study area. Although *Pinus ponderosa* and *Leucopoa kingii* (spike fescue) were found together in the study area, the species were not present on the Open Space property in the quantities or population sizes that typically express a viable *Pinus ponderosa/Leucopoa kingii* community. The same is true of *Andropogon gerardii* (big bluestem), *Bouteloua curtipendula* (sideoats grama), *Bouteloua gracilis* (blue grama), and *Schizachyrium scoparium* (little bluestem), which although present in the study area, did not form the xeric tallgrass prairie community which consists of these species.

Some communities in Doudy Draw may be unusual and appear to be limited to the foothills of the Front Range. The dominant species is *Crataegus macracantha*, with *Padus virginiana* (chokecherry), *Rhus aromatica* ssp. *trilobata* (skunkbrush) and *Salix irrorata* (bluestem willow) as common associates. This community (located in T2S, R70W, section 6, the NW4) has not been documented in published literature and should be investigated. The upper Doudy Draw riparian area contains an interesting and unusual mixture of species that are eastern woodland relicts [*Agrimonia striata* (agrimony), *Aralia nudicaulis* (wild sarsaparilla), *Corylus cornuta* (hazelnut), *Sanicula marilandica* (black snakeroot)] and are only found in the cool moist foothill ravines. This area (located in T2S, R70W, section 6, SW4 of the NW4) also merits further investigation to determine the status of the plant communities.

Historical and present land use at Doudy Draw has significantly altered the landscape. Visible impacts include the diversion and impoundment of water sources for both urban and livestock uses, mining activity at several sites, fragmentation of continuous habitat by roads, construction of a power line and the associated reseeding, and livestock grazing, all of which contribute, to some degree, to the alteration of native plant communities.

Natural areas within the Front Range of Colorado are highly threatened by human activity (development, agricultural conversion, etc.) and will be more threatened in the future. Areas that are in a natural or restorable condition are valuable because they represent the natural heritage and biodiversity of the area, much of which has been lost or degraded since European settlement. The proximity of the Doudy Draw/Eldorado Mountain property to other open space properties (in both Boulder and Jefferson counties), and Golden Gate Canyon State Park provides a connection of natural systems that is also rare on the Colorado Front Range and may have value as a corridor for species migration.

RECOMMENDATIONS

1. **Continue inventory for rare species and establish monitoring programs on those rare plant populations identified in this study.**
   Due to year to year population fluctuations (well known for *Spiranthes diluvialis*), differences in phenology, or chance, some plants (especially rare plants) can be potentially overlooked in a one year study. Any absence of data does not necessarily mean that other rare plant populations do not occur on the site. In addition, because of limited field time, the higher elevation areas on the western side of the property were not surveyed as thoroughly as others. An additional 10-15 days of field work next season would insure that the species list and rare plant inventory are as thorough as possible and would could be used to for additional searching for those species listed under Methods step 2 on page 2.

2. **Investigate the possibility of restoration of natural communities.**
   The effects of fire on the ecosystems (mainly the ponderosa pine forests and woodlands, and the grasslands) should be investigated, especially the historical role and frequency along the Front Range. Implementation of fire management should await more detailed invertebrate information, especially insect data. High frequency prescribed fires on a tallgrass prairie in Oklahoma are believed to have reduced insect species richness in that system (Paul Opler, personal communication).

   Fire or grazing regimes that tend to favor native species over adventives may help restore some of the plant communities to a more natural species composition. Open Space range management personnel are best qualified to identify specific fire or grazing practices which are most effective in controlling adventive species. Adventives were most common along the gravel roads in the study area and along the access trail near lower Doudy Draw in T1S, R70W, section 29 (Nan Lederer, personal communication). Areas with high concentrations of adventive species were not specifically mapped or documented, as this was beyond the scope of the study.

3. **Expand public awareness of the need for protecting areas determined to be significant to natural diversity.**
Natural lands are becoming more scarce, especially near densely populated metropolitan areas. Rare species may continue to decline if not given appropriate protective measures on these natural areas. Increasing the public's knowledge of the remaining significant areas will build support for the programmatic initiatives necessary to protect them. Such activities could be done through interpretive facilities, conferences or meetings to stimulate public involvement, information pamphlets, and others.

4. **Proactively plan future development to minimize impacts to natural heritage resources.**
Locations of any future development should be designed to minimize impacts to natural heritage resources. Further fragmentation of the landscape should be avoided if possible.

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Appendix A

Colorado's Natural Heritage Program

The Colorado Natural Heritage Program (CNHP) is the latest stage of a fourteen year development. Building on a solid base of biodiversity information, CNHP was relocated from the Division of Parks and Outdoor Recreation into the University of Colorado Museum in the spring of 1992. With an increased staff, the Program is revitalized and updating comprehensive information on the rare, threatened, and endangered species and significant ecosystems in Colorado. The multi-disciplinary team of scientists and information managers gather information and incorporate it into the continually updated databases. CNHP is part of an international network of conservation data centers that use the Biological and Conservation Databases (BCD) (developed by The Nature Conservancy). Concentrating on site-specific data for each element of natural diversity, the accurate status of each element is known. The mapped data illustrate sites that are important to the conservation of Colorado's natural biological diversity. By using the element ranks and the quality of each occurrence, priorities can be established for the protection of the most sensitive sites. It is by having an updated locational database and priority-setting system that CNHP can provide its most effective, proactive land-planning tools.

The information gathered by CNHP is on species, natural communities, and ecosystems. Each of these significant natural features (species and natural communities) is an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative rarity on a five-point scale (1 = extremely rare; 5 = abundant).

Table 1. Definition of Natural Heritage state rarity ranks. Global rarity ranks are similar, but refer to a species' rarity throughout it range. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a character. Note that GA and GN are not used and GX means extinct. These ranks should not be interpreted as legal designations.

S1	Extremely rare: usually 5 or fewer occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.
S2	Very rare; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.
S3	Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
S4	Common; usually > 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
S5	Very common; demonstrably secure under present conditions.
SA	Accidental in the state.
SH	Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.
S#B	Same rank as the numbered S-series, but refers to the breeding season rarity of migrants.
S#N	Same rank as the numbered S-series, but refers to the non-breeding season rarity of migrants; where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SU	Status uncertain, often because of low search effort or cryptic nature of the element.
SX	Apparently extirpated from the state.

The primary criterion for ranking elements is the number of occurrences, i.e. the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include the condition of the occurrences, the number of protected occurrences, and threats. However, the emphasis remains on the number of occurrences such that ranks are an index of known biological rarity. These ranks are assigned both in terms of the element's rarity within Colorado (its State or S-rank) and the element's rarity over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the rarity of the element. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species are listed as endangered or threatened, and Natural Heritage rarity ranks should not be interpreted as legal designations.

The spot on the landscape that supports a particular population of a specific species or a specific stand of a given community type is an **element occurrence**. The CNHP has mapped over 3,500 element occurrences in Colorado. Information on the location and quality of these element occurrences is also entered into the computerized Biological and Conservation Databases (BCD). This computer system, developed by The

Nature Conservancy, is utilized by the international network of heritage programs and conservation data centers. All centers utilize the same methodology, allowing a unique, direct comparison of information throughout the area covered.

In addition to ranking each element in terms of rarity, Natural Heritage staff scientists rank each element occurrence so that protection efforts can be aimed not only at the rarest elements, but at the best examples of each. Element occurrences are ranked in terms of the **quality** (size, vigor, etc.) of the population or community, the **condition** or naturalness of the habitat, the long-term **viability** of the population or community, and the **defensibility** (ease or difficulty of protecting) the occurrence. Given the relationship between a natural community and its environment, community occurrences are largely ranked in terms of their quality and size.

One of the ways that the Colorado Natural Heritage Program uses these element and element occurrence ranks is to assess the overall significance of a site, which may include one or many element occurrences. Based on these ranks, each site is assigned a **biodiversity** (or B-) **rank**:

B1 Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species.

B2 Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.

B3 High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.

B4 Moderate Significance: good example of a community type, excellent or good occurrence of state-rare species.

B5 General Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

What is Biological Diversity?

Biological diversity has recently become an important management issue for many natural resource professionals and forms the basis for the "New Perspectives" and the "Ecosystem Management" initiatives of the U. S. Forest Service. In the most simple terms, biological diversity, or simply biodiversity, is the full variety of plant and animal life in an area **AND** the ecological processes of which they are a part. This concept includes all living organisms from bacteria and fungi, invertebrate animals, mosses and lichens, and the "higher life forms" of plants and animals.

The biological diversity of an area can be described at four levels:

1. Genetic Diversity -- the genetic variation within a population and among

populations of a plant or animal species. The genetic makeup of a species is variable between populations of a species within its geographic range. Loss of a species' population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region.

2. Species Diversity -- the total number and abundance of plant and animal species in an area.

3. Community Diversity -- the variety of natural communities or ecosystems within that area. These communities may be diagnostic or even endemic to an area.

4. Landscape Diversity -- the type, condition, pattern, and connectedness of natural communities or ecosystems within a landscape. Fragmentation of forested landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region.

Colorado Natural Heritage Program Staff:

Christopher A. Pague - Coordinator/Zoologist
Aaron Ellingson - Assistant Zoologist
Susan Spackman - Botanist
Nan Lederer - Contract Botanist
Vicki Frey - Assistant Botanist
Steve Kettler - Ecologist
Gwen Kittel - Riparian Ecologist
Renee Rondeau - Assistant Riparian Ecologist
Katherine Pague - Information Manager
Diane Bacher - Administrative Assistant
Catherine Porter - Data Handler

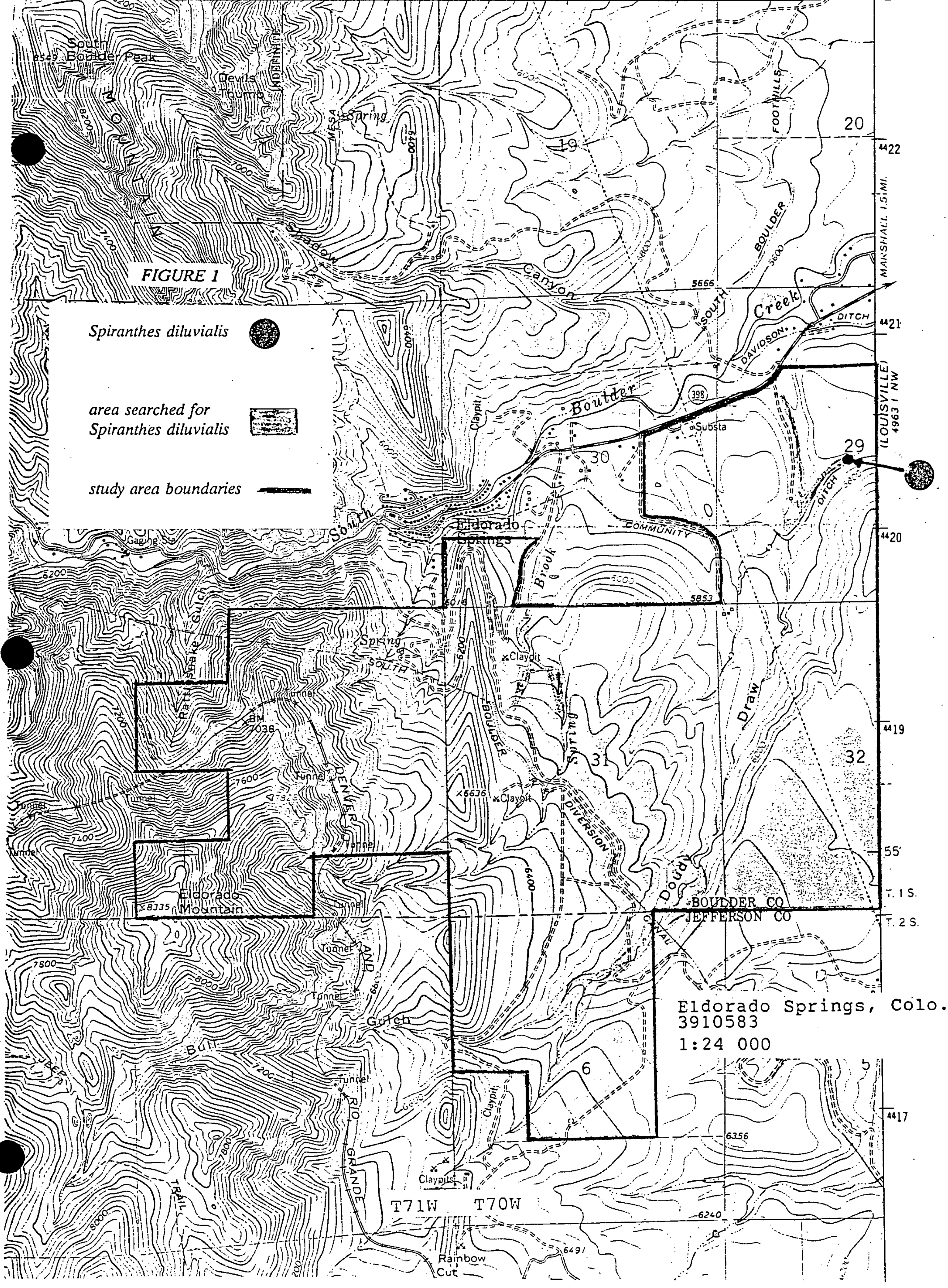
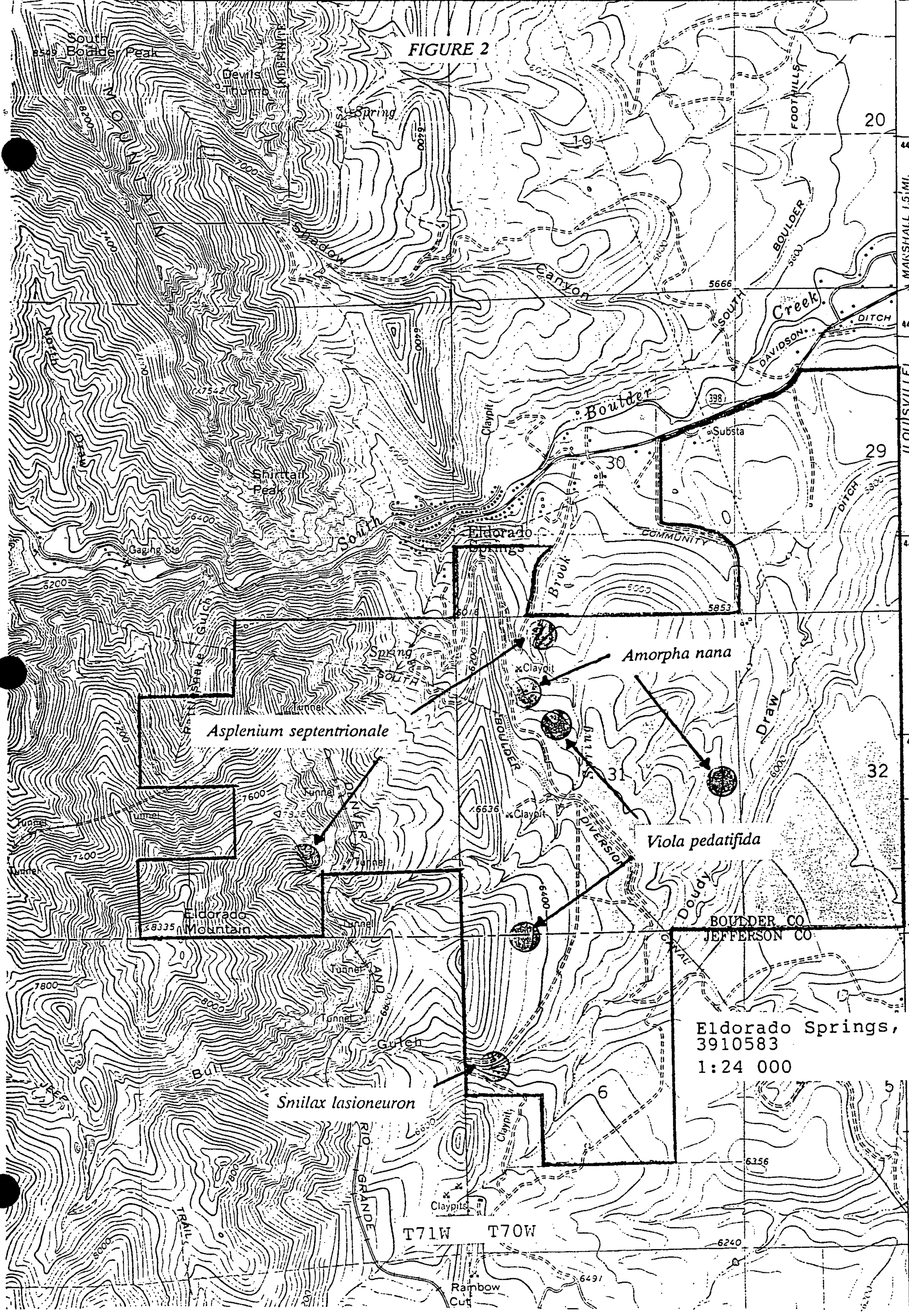


FIGURE 1
Spiranthes diluvialis
area searched for Spiranthes diluvialis
study area boundaries
South Boulder Peak
Devils Thumb
Mesa Spring
Shadow Canyon
South Boulder Creek
Davidson Ditch
Community Ditch
Eldorado Springs
Gaging Sta
Rattlesnake Gulch
Eldorado Mountain
Doudy Draw
Spring Brook
South Boulder Diversion Canal
Denver and Rio Grande
Bull Gulch
Rainbow Cut
Substa
Claypit
Tunnel
BM 7038
BOULDER CO
JEFFERSON CO
T. 1 S.
T. 2 S.
T71W
T70W
MARSHALL 1.5 MI.
(LOUISVILLE) 4963 I NW
Eldorado Springs, Colo.
3910583
1:24 000

FIGURE 2



Amorpha nana
Asplenium septentrionale
Viola pedatifida
Smilax lasioneuron
Eldorado Springs
Eldorado Mountain
South Boulder Peak
Devils Thumb
Shirttail Peak
Shadow Canyon
South Boulder Creek
Community Ditch
Davidson Ditch
Doudy Draw
BOULDER CO
JEFFERSON CO
Eldorado Springs, Colo.
3910583
1:24 000
T71W T70W
T. 1 S.
T. 2 S.

Appendix B

COMPLETED NATURAL HERITAGE FORMS

PLANT SPECIES OF SPECIAL CONCERN SURVEY FORM
COLORADO NATURAL HERITAGE PROGRAM

C/O UNIVERSITY OF COLORADO MUSEUM*HUNTER 115 CB 315*BOULDER, CO 80309-0315*(303)492-4719

DATE OF SURVEY: 8/9/93

OBSERVER(S) Tim Hogan (CU Herbarium) & Curry Tallman (City of Bldr. Open Space 'weed crew')

TAXONOMY:

SCIENTIFIC NAME: Spiranthes diluvialis Sheviak COMMON NAME Ute Lady's Tresses

LOCATION: (Attach a copy of pertinent 7.5' or 15' topographic map section with locations of populations/subpopulations outlined, one map for each sensitive species described)

COUNTY: Boulder USGS QUADRANGLE: Eldorado Springs

TOWNSHIP: 1S RANGE: 70W SECTION: 29 1/4 SEC.: ____

ADDITIONAL T/R/S, SECTIONS OR 1/4 SECs.: center of SEC 29

ELEVATION (at population center (and range of population if known)): 5760

NATIONAL FOREST/BLM DISTRICT: ____ F.S. DISTRICT/BLM RESOURCE AREA ____

LAND OWNERSHIP/MANAGEMENT (if not USFS/BLM): City of Boulder Open Space

DIRECTIONS TO SITE (refer to roads, trails, geographic features, etc.): From Doudy Draw trailhead on State Hwy 128 (State Highway 170 on newer maps) (ca. one mile east of Eldorado Springs), go south, ca. 1/4 mile on paved trail; ca. 400 yards from picnic area, a moist swale is visible to the east that is fed by the irrigation ditch above it. (See other side).

HABITAT:

VEGETATION STRUCTURE WITHIN POPULATION AREA:

TOTAL TREE COVER (%) 0 TOTAL SHRUB COVER (%) <5%

TOTAL FORB COVER (%) 20 (?) TOTAL GRAMINOID COVER (%) 80

TOTAL MOSS/LICHEN COVER (%) ____ TOTAL BARE GROUND COVER ____

ASSOCIATED PLANT COMMUNITY: (list dominant species currently present, include age structure if known):

Agrostis gigantea, Juncus arcticus, J. saximontanus, Carex nebrascensis, Schoenoplectus pungens, Lycopus americanus, Cichorium intybus, Cirsium arvense

HABITAT TYPE: "wetland"

ADDITIONAL ASSOCIATED PLANT SPECIES: ____

ASPECT (S, SE, NNW, etc.): ____ % SLOPE ____ SLOPE SHAPE (concave, convex, straight, etc.) ____

LIGHT EXPOSURE (open, shaded, partial shade, etc.): open

TOPOGRAPHIC POSITION (crest, upperslope, midslope, lowerslope, bottom, etc.): lowerslope

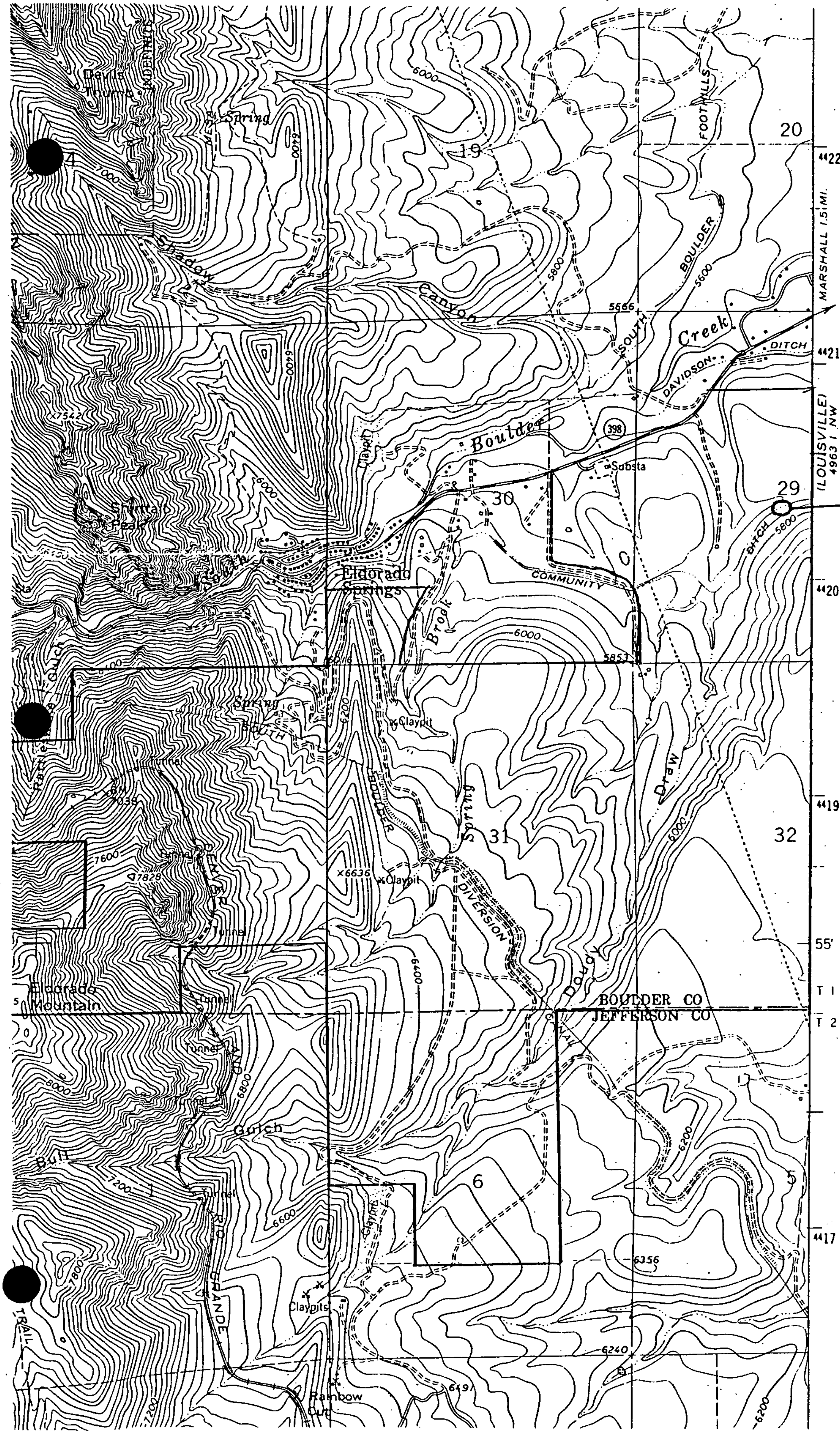
DISTURE: (dry, moist, saturated, inundated, seasonal seepage, etc.) moist, seasonaly inundated (?)

PARENT MATERIAL: colluvium (?)

GEOMORPHIC LAND FORM (e.g. glaciated mountain slopes and ridges, alpine glacial valley, rolling uplands, breaklands, alluvial-colluvial-lacustrine (floodplains, terraces, etc.), rockslides):

River terrace mesa (S. Boulder Creek drainage) in piedmont of Boulder Valley

Eldorado Springs Quadrangle



Devils Thumb
Spring
Shadow
Canyon
South Boulder Creek
Boulder
Creek
Davidson
Ditch
Foothills
Marshall 1.5 MI.
(LOUISVILLE) 4963 I NW
398
Substa
Shirttail Peak
Eldorado Springs
Community
Ditch
Brook
Claypit
Spring
South
Boulder
Diversion
Draw
Doudy
Boulder Co
Jefferson Co
T 1 S
T 2 S
Eldorado Mountain
Tunnel
Denver and Rio Grande
Gulch
Bull
Claypits
Rainbow Cut
Trail
19
20
29
30
31
32
6
5
4422
4421
4420
4419
4417
55'
5666
5853
6356
6240
6491

Spiranthes diluvialis

6552

PLANT SPECIES OF SPECIAL CONCERN SURVEY FORM
COLORADO NATURAL HERITAGE PROGRAM

C/O UNIVERSITY OF COLORADO MUSEUM*HUNTER 115 CB 315*BOULDER, CO 80309-0315*(303)492-4719

DATE OF SURVEY: 5/27/93

OBSERVER(S) Tim Hogan, Nan Lederer

TAXONOMY:

SCIENTIFIC NAME: Viola pedatifida COMMON NAME Birdfoot violet

LOCATION: (Attach a copy of pertinent 7.5' or 15' topographic map section with locations of populations/subpopulations outlined, one map for each sensitive species described)

SITE NAME: Doudy Draw City Open Space

COUNTY: Boulder / Jefferson USGS QUADRANGLE: Eldorado Springs

TOWNSHIP: 1S RANGE: 70W SECTION: 31 1/4 SEC.: NW

ADDITIONAL T/R/S, SECTIONS OR 1/4 SECs.: Also T2S, R70W, S6, NW 1/4

ELEVATION (at population center (and range of population if known)): 6200' - 6450'

NATIONAL FOREST/BLM DISTRICT: _____ F.S. DISTRICT/BLM RESOURCE AREA _____

LAND OWNERSHIP/MANAGEMENT (if not USFS/BLM): City of Boulder

DIRECTIONS TO SITE (refer to roads, trails, geographic features, etc.: 1/4 mile east of Eldorado Springs, take County Rd. 67 south to gate. Walk up Boulder Diversion Canal service road. One sub-population is just east of dogleg where road curves east then south; other is 1/2 mi. south in meadow on Boulder / Jefferson County line.

HABITAT:

VEGETATION STRUCTURE WITHIN POPULATION AREA: (2 sub-populations separated by /)

TOTAL TREE COVER (%) 30% / 1% TOTAL SHRUB COVER (%) 5% / 5%

TOTAL FORB COVER (%) 10% / 20% TOTAL GRAMINOID COVER (%) 20% / 40%

TOTAL MOSS/LICHEN COVER (%) _____ TOTAL BARE GROUND COVER _____

ASSOCIATED PLANT COMMUNITY: (list dominant species currently present, include age structure if known):

Ponderosa pine (young), Poa compressa, Poa agassizensis, Phleum pratense, Pneumonanthe affinis, Muhlenbergia montana, Stipa comata.

HABITAT TYPE: Woodland / Meadow; rocky sites

ADDITIONAL ASSOCIATED PLANT SPECIES: Schizachyrium scoparium, Koeleria macrantha, Bouteloua curtipendula

ASPECT (S, SE, NNW, etc.): E % SLOPE 0-5% SLOPE SHAPE (concave, convex, straight, etc.) _____

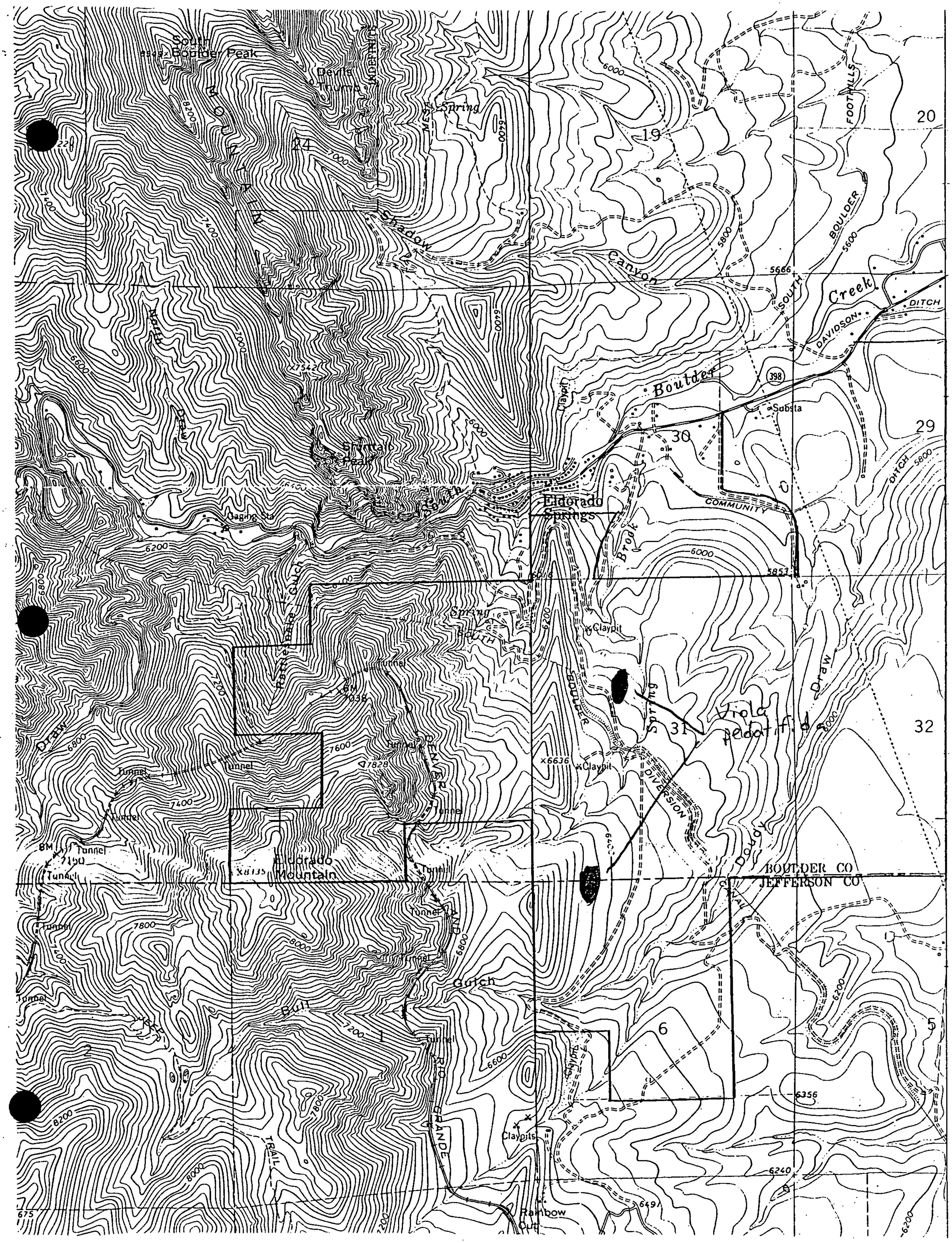
LIGHT EXPOSURE (open, shaded, partial shade, etc.): open to partial shade

TOPOGRAPHIC POSITION (crest, upperslope, midslope, lowerslope, bottom, etc.): midslope

MOISTURE: (dry, moist, saturated, inundated, seasonal seepage, etc.) Dry

PARENT MATERIAL: _____

GEOMORPHIC LAND FORM (e.g. glaciated mountain slopes and ridges, alpine glacial valley, rolling uplands, breaklands, alluvial-colluvial-lacustrine (floodplains, terraces, etc.), rockslides): piedmont mesas


South Boulder Peak
Devils Thumb
Spring
24
19
20
Shadow
Canyon
SOUTH
BOULDER
Creek
DAVIDSON
DITCH
FOOTHILLS
Boulder
398
Substa
30
29
North
Draw
Shirttail Peak
Gaging Sta
South
Eldorado Springs
COMMUNITY
DITCH
Brodt
5851
Spring
Claypit
BOULDER
DIVERSION
Spring
31
32
Viola pedatifida
Draw
Tunnel
BM 7038
x7828
x6636
Eldorado Mountain
BOULDER CO
JEFFERSON CO
Doudy
Gulch
Bull
6
5
2
1
Claypits
TRAIL
RIO GRANDE
6356
6240
Rainbow Cut
6000
6200
6400
6800
7000
7200
7400
7600
7800
8000
8200
5600
5800

PLANT SPECIES OF SPECIAL CONCERN SURVEY FORM
COLORADO NATURAL HERITAGE PROGRAM

C/O UNIVERSITY OF COLORADO MUSEUM*HUNTER 115 CB 315*BOULDER, CO 80309-0315*(303)492-4719

DATE OF SURVEY: 6/25/93

OBSERVER(S) Nan Lederer, Tim Hogan

TAXONOMY:

SCIENTIFIC NAME: Asplenium septentrionale COMMON NAME Grass fern

LOCATION: (Attach a copy of pertinent 7.5' or 15' topographic map section with locations of populations/subpopulations outlined, one map for each sensitive species described)

SITE NAME: Eldorado Mountain

COUNTY: Boulder USGS QUADRANGLE: Eldorado Springs

TOWNSHIP: 1S RANGE: 71W SECTION: 36 (unsurveyed) 1/4 SEC.: ____

ADDITIONAL T/R/S, SECTIONS OR 1/4 SECs.: T1S, R70W, S31

ELEVATION (at population center (and range of population if known)): 7000 ft. & 6000 ft.

NATIONAL FOREST/BLM DISTRICT: ____ F.S. DISTRICT/BLM RESOURCE AREA ____

LAND OWNERSHIP/MANAGEMENT (if not USFS/BLM): City of Boulder Open Space

DIRECTIONS TO SITE (refer to roads, trails, geographic features, etc.:
Sub-pop. a: On talus slope, lower slope Eldorado Mtn. at base of Micky Mouse Wall, just west of RR tracks. Sub-pop. b: On large boulder along Spring Brook just south of Open Space property boundary fence

HABITAT:

VEGETATION STRUCTURE WITHIN POPULATION AREA:

TOTAL TREE COVER (%) ____ TOTAL SHRUB COVER (%) ____

TOTAL FORB COVER (%) ____ TOTAL GRAMINOID COVER (%) ____

TOTAL MOSS/LICHEN COVER (%) ____ TOTAL BARE GROUND COVER ____

ASSOCIATED PLANT COMMUNITY: (list dominant species currently present, include age structure if known):

HABITAT TYPE: Boulders, in crevices

ADDITIONAL ASSOCIATED PLANT SPECIES: ____

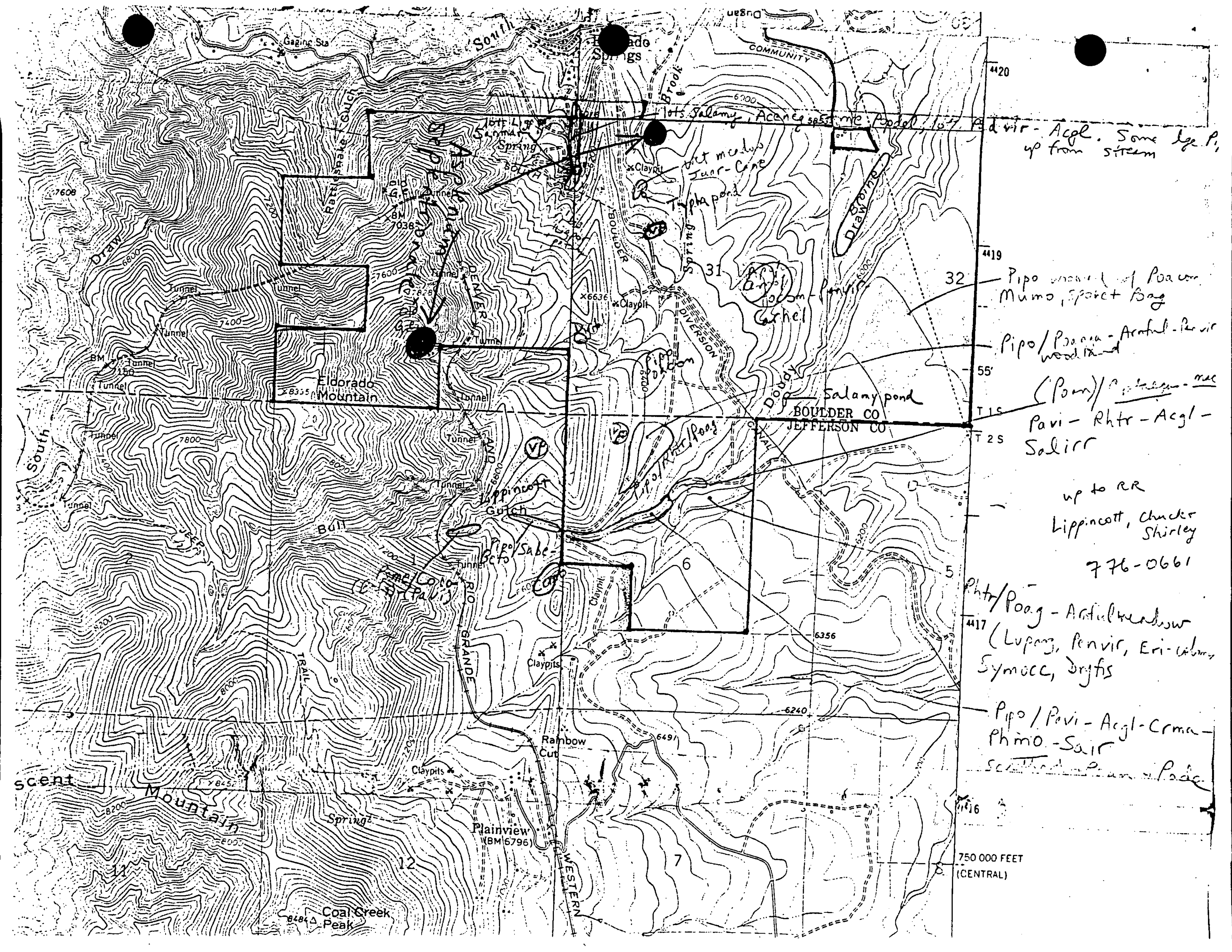
ASPECT (S, SE, NNW, etc.): ____ % SLOPE ____ SLOPE SHAPE (concave, convex, straight, etc.) ____

LIGHT EXPOSURE (open, shaded, partial shade, etc.): ____

TOPOGRAPHIC POSITION (crest, upperslope, midslope, lowerslope, bottom, etc.): ____

MOISTURE: (dry, moist, saturated, inundated, seasonal seepage, etc.) ____

PARENT MATERIAL: ____



Eldorado Springs
Gaging Sta
South
Dugan
COMMUNITY
Brook
Rattlesnake Gulch
Draw
Spring
Claypit
BOULDER
DIVERSION
CANAL
Doudy
Draw
BOULDER CO
JEFFERSON CO
DENVER
AND
RIO
GRANDE
WESTERN
Tunnel
Eldorado Mountain
Lippincott Gulch
Bull
TRAIL
Claypits
Rainbow Cut
Plainview (BM 6796)
Coal Creek Peak
Mountain
Spring
31
32
5
6
7
11
12
T 1 S
T 2 S
4420
4419
4417
4416
55'
6356
6240
6491
7608
8335
750 000 FEET (CENTRAL)
Salamy pond
Typha pond
Pipo/Rhtr/Poag
Agl. Some lge Pi up from stream
Pipo
Mumo, Sporet + Bag
Pavi - Rhtr - Acgl - Salirr
up to RR
Lippincott, Chuck Shirley
776-0661
Rhtr/Poag
Symocc, Dryfis
Pipo/Pavi - Acgl - Crma - Phmo - Sair

PLANT SPECIES OF SPECIAL CONCERN SURVEY FORM
COLORADO NATURAL HERITAGE PROGRAM

C/O UNIVERSITY OF COLORADO MUSEUM*HUNTER 115 CB 315*BOULDER, CO 80309-0315*(303)492-4719

DATE OF SURVEY: 6/9/93

OBSERVER(S) Tim Hogan, Nan Lederer

TAXONOMY:

SCIENTIFIC NAME: Smilax lasioneuron COMMON NAME _____

LOCATION: (Attach a copy of pertinent 7.5' or 15' topographic map section with locations of populations/subpopulations outlined, one map for each sensitive species described)

SITE NAME: Doudy Draw

COUNTY: Boulder USGS QUADRANGLE: Eldorado Springs

TOWNSHIP: 2S RANGE: 70W SECTION: 6 1/4 SEC.: NW

ADDITIONAL T/R/S, SECTIONS OR 1/4 SECs.: _____

ELEVATION (at population center (and range of population if known)): 6400 ft.

NATIONAL FOREST/BLM DISTRICT: _____ F.S. DISTRICT/BLM RESOURCE AREA _____

LAND OWNERSHIP/MANAGEMENT (if not USFS/BLM): City of Boulder Open Space

DIRECTIONS TO SITE (refer to roads, trails, geographic features, etc.:
From either the Doudy Draw trailhead or County Rd. 67, hike up to upper Doudy Draw approx. ½ mile above Boulder Diversion Canal

HABITAT:

VEGETATION STRUCTURE WITHIN POPULATION AREA:

TOTAL TREE COVER (%) 30 TOTAL SHRUB COVER (%) 50

TOTAL FORB COVER (%) 20 TOTAL GRAMINOID COVER (%) 5

TOTAL MOSS/LICHEN COVER (%) _____ TOTAL BARE GROUND COVER _____

ASSOCIATED PLANT COMMUNITY: (list dominant species currently present, include age structure if known):
Pinus ponderosa - narrowleaf cottonwood / Padus virginianus - Acer glabrum - Crataegus macrantha

HABITAT TYPE: Riparian

ADDITIONAL ASSOCIATED PLANT SPECIES: _____

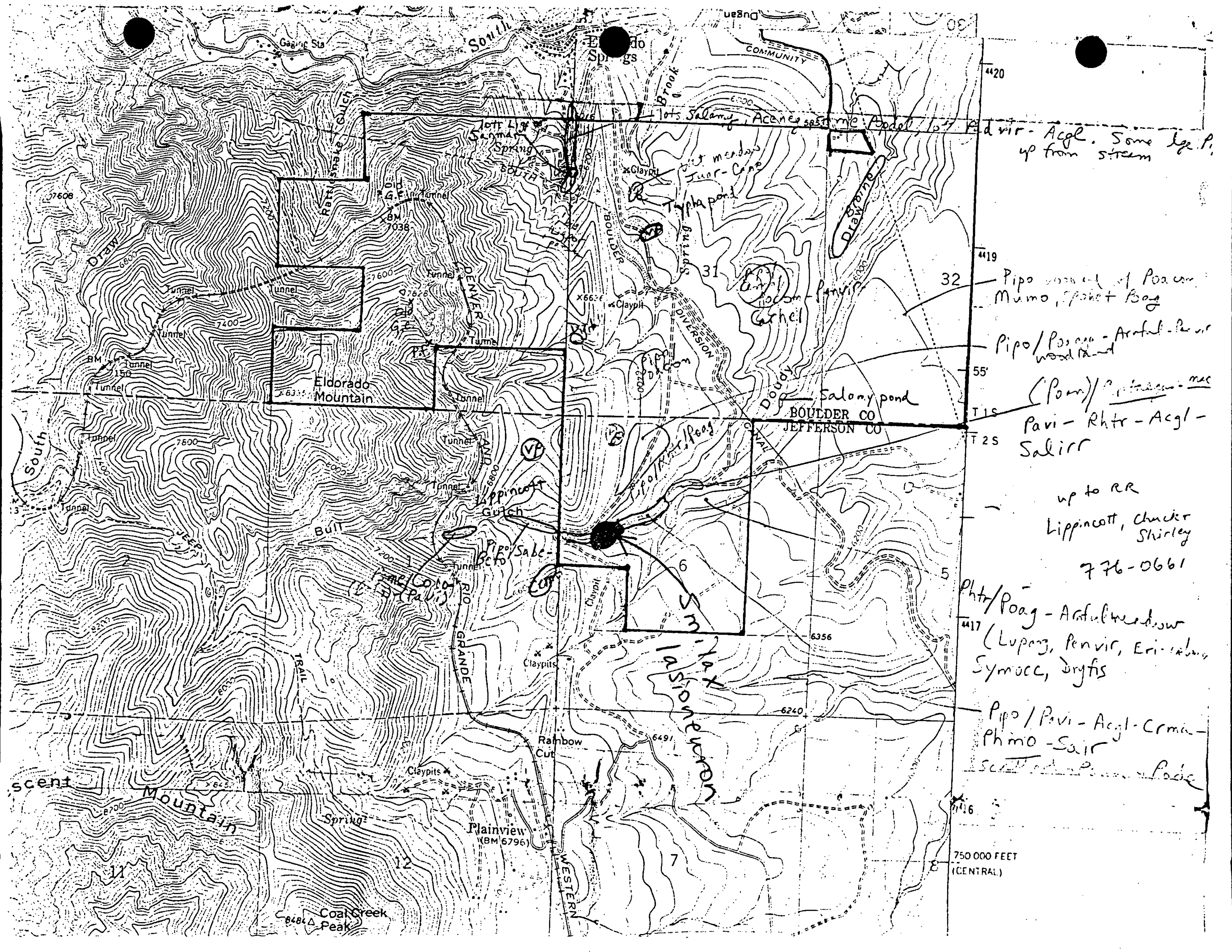
ASPECT (S, SE, NNW, etc.): E % SLOPE 5 SLOPE SHAPE (concave, convex, straight, etc.) _____

LIGHT EXPOSURE (open, shaded, partial shade, etc.): Shaded

TOPOGRAPHIC POSITION (crest, upperslope, midslope, lowerslope, bottom, etc.): bottom

MOISTURE: (dry, moist, saturated, inundated, seasonal seepage, etc.) Moist

PARENT MATERIAL: _____


Eldorado Springs
South
COMMUNITY
Dugan
Brook
Gaging Sta
Rattlesnake Gulch
Eldorado Mountain
DENVER
AND
RIO
GRANDE
WESTERN
BOULDER
DIVERSION
CANAL
Doudy
Draw
Spring
BOULDER CO
JEFFERSON CO
T1S
T2S
Lippincott Gulch
Claypit
Claypits
Tunnel
BM 7038
Rainbow Cut
Plainview (BM 6796)
Coal Creek Peak
Mountain
TRAIL
JEEP
750 000 FEET (CENTRAL)
31
32
5
6
7
12
11
Smilax lasioneuron
Typha pond
Salamy pond
Pipo/Sabe-Beto
lots Salamy, Acene
Advir - Acgl. Some lge P. up from stream
Pipo / Poa ... Mumo, ... Bog
Pipo / Poa ... - Artful - Penvir woodland
(Poan) / ...
Pavi - Rhtr - Acgl - Salirr
up to RR
Lippincott, Chuck Shirley
776-0661
Rhtr / Poag - Artful meadow
(Lupang, Penvir, Eri..., Symocc, Dryfis
Pipo / Pavi - Acgl - Crma - Phmo - Sair

PLANT SPECIES OF SPECIAL CONCERN SURVEY FORM
COLORADO NATURAL HERITAGE PROGRAM

C/O UNIVERSITY OF COLORADO MUSEUM*HUNTER 115 CB 315*BOULDER, CO 80309-0315*(303)492-4719

DATE OF SURVEY: 9/14/93

OBSERVER(S) Nan Lederer, Tim Hogan, Steve Kettler

TAXONOMY:

SCIENTIFIC NAME: Amorpha nana COMMON NAME Dwarf wild indigo

LOCATION: (Attach a copy of pertinent 7.5' or 15' topographic map section with locations of populations/subpopulations outlined, one map for each sensitive species described)

SITE NAME: Doudy Draw area

COUNTY: Boulder USGS QUADRANGLE: Eldorado Springs

TOWNSHIP: 1S RANGE: 70W SECTION: 31 1/4 SEC.: NW and SE

ADDITIONAL T/R/S, SECTIONS OR 1/4 SECs.:

ELEVATION (at population center (and range of population if known)): 6000 ft.

NATIONAL FOREST/BLM DISTRICT: F.S. DISTRICT/BLM RESOURCE AREA

LAND OWNERSHIP/MANAGEMENT (if not USFS/BLM): City of Boulder Open Space

DIRECTIONS TO SITE (refer to roads, trails, geographic features, etc.:
Sub-population a: From Doudy Draw trailhead east of Eldorado Springs, walk up trail along Doudy Draw ca. 1.5 mi, walk west up sideslope. Sub-population b: Drive up County Rd. 67 to g[redacted] walk up Spring Brook; plants are on slope west of small cattail pond.

HABITAT:

VEGETATION STRUCTURE WITHIN POPULATION AREA:

TOTAL TREE COVER (%) Ø TOTAL SHRUB COVER (%) 2

TOTAL FORB COVER (%) 10 TOTAL GRAMINOID COVER (%) 80

TOTAL MOSS/LICHEN COVER (%) TOTAL BARE GROUND COVER

ASSOCIATED PLANT COMMUNITY: (list dominant species currently present, include age structure if known):
Poa compressa, Bromopsis inermis, Poa pagassizensis, Stipa viridula, Gutierrezia sarothrae, Liatris punctata

HABITAT TYPE: Grassland

ADDITIONAL ASSOCIATED PLANT SPECIES:

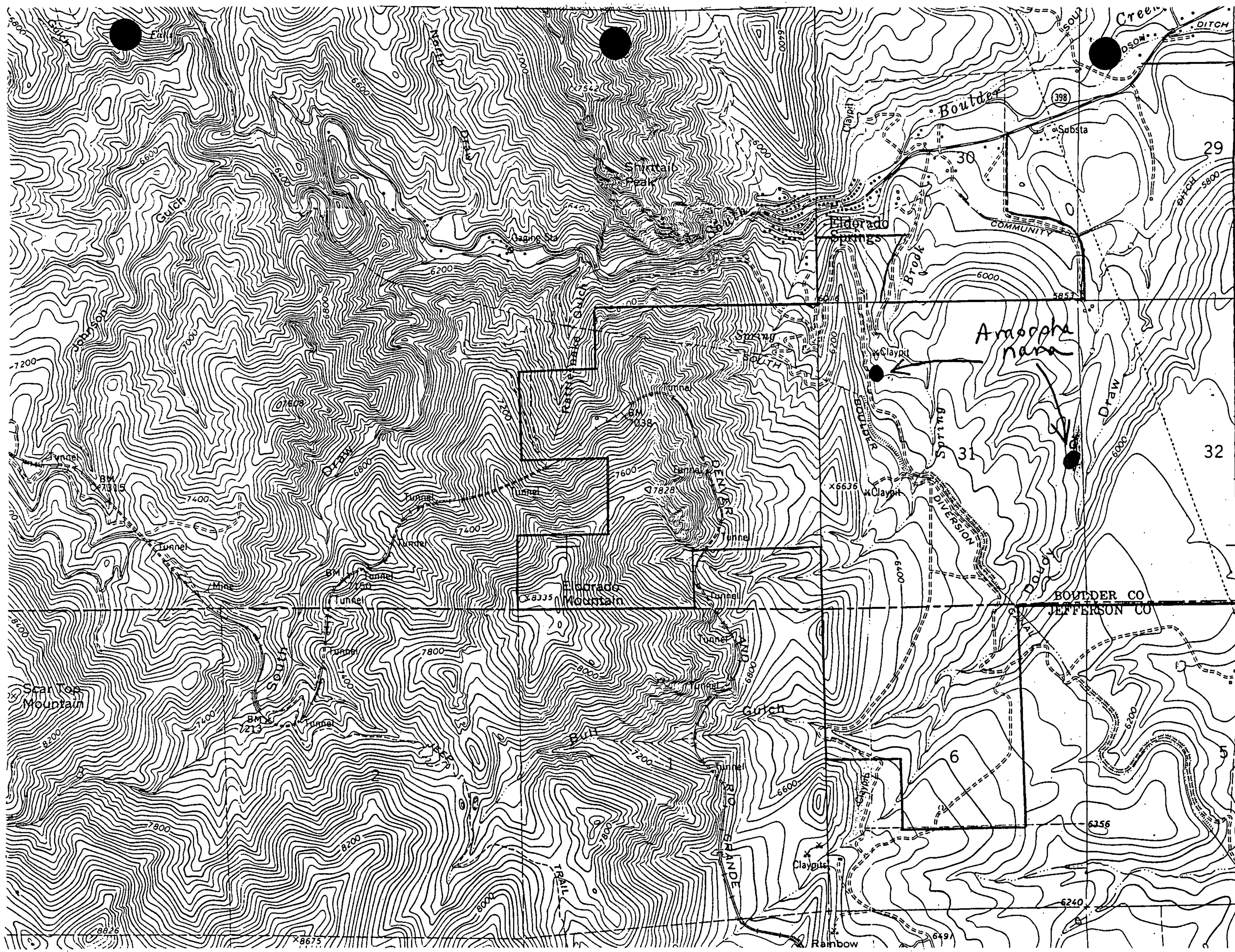
ASPECT (S, SE, NNW, etc.): E % SLOPE 20 SLOPE SHAPE (concave, convex, straight, etc.)

LIGHT EXPOSURE (open, shaded, partial shade, etc.): Open

TOPOGRAPHIC POSITION (crest, upperslope, midslope, lowerslope, bottom, etc.): lowerslope

MOISTURE: (dry, moist, saturated, inundated, seasonal seepage, etc.) Dry

[redacted]ENT MATERIAL:


Amorpha nana
Eldorado Springs
Shirttail Peak
Eldorado Mountain
Scar Top Mountain
BOULDER CO
JEFFERSON CO
DENVER AND RIO GRANDE
COMMUNITY DITCH
DIVERSION
Boulder Creek
Rattlesnake Gulch
Johnson Gulch
North Draw
Spring Brook
Bull Gulch
Gaging Sta
Substa
Claypit
Claypits
Rainbow
Tunnel
Mine
TRAIL
(LOUISVILLE)
29
30
31
32
5
6
398
5857
6356
6240
6491
X6636
X8335
X8675
8826

Appendix C

DOUDY DRAW SPECIES LIST

Doudy Draw Species List

Nomenclature follows Weber (Weber and Wittmann, 1992). If other names are considered to be more familiar, these are provided. Those species marked with an asterisk (*) were not observed by Hogan or Lederer, but are reported to be in the Herbarium of City Open Space. In addition to the local manuals (Weber, 1976, 1990), other works used in compiling this list include the *Flora of the Great Plains* (Great Plains Flora Association, 1986), *Intermountain Flora* (Cronquist et al., 1977), *Manual of the Plants of Colorado* (Harrington, 1954), and *Vascular Plants of Wyoming* (Dorn, 1988).

FERNS and FERN ALLIES

ASPIDIACEAE SHIELD FERN FAMILY

Dryopteris filix-mas (L.) Schott MALE FERN.

ASPLENIACEAE SPLEENWORT FAMILY

Asplenium septentrionale (L.) Hoffman GRASS FERN.

ATHYRIACEAE LADY FERN FAMILY

Cystopteris fragilis (L.) Bernhardi BRITTLE FERN.

CRYPTOGRAMMACEAE ROCK BRAKE FAMILY

Cryptogramma acrostichoides R.Brown AMERICAN ROCK BRAKE. [*C. crispa* (L.) R.Br. ssp. *acrostichoides* (R.Br.) Hultén]

EQUISETACEAE HORSETAIL FAMILY

Equisetum arvense L. FIELD HORSETAIL.
Hippochaete laevigata (A.Braun) Farwell SMOOTH SCOURING-RUSH. [*Equisetum laevigatum* A.Braun]

HYPOLEPIDACEAE BRACKEN FAMILY

Pteridium aquilinum (L.) Kuhn ssp. *lanuginosum* (Bongard) Hultén BRACKEN FERN.

SELAGINELLACEAE LITTLE CLUB-MOSS FAMILY

Selaginella densa Rydberg

SINOPTERIDACEAE LIPFERN FAMILY

Cheilanthes fendleri Hooker FENDLER'S LIP FERN.

WOODSIACEAE WOODSIA FAMILY

Woodsia scopulina Eaton ROCKY MOUNTAIN WOODSIA.

GYMNOSPERMS

CUPRESSACEAE CYPRESS FAMILY

Juniperus communis L. ssp. *alpina* (Smith) Celakowski COMMON JUNIPER.
Sabina scopulorum (Sargent) Rydberg ROCKY MOUNTAIN JUNIPER. [*Juniperus scopulorum* Sarg.]

PINACEAE PINE FAMILY

Pinus flexilis James LIMBER PINE.
Pinus ponderosa Douglas ssp. *scopulorum* (Watson) Weber PONDEROSA PINE.
Pseudotsuga menziesii (Mirbel) Franco DOUGLAS FIR.

ANGIOSPERMS

ACERACEAE MAPLE FAMILY

Acer glabrum Torrey MOUNTAIN MAPLE.
Negundo aceroides (L.) Moench BOX ELDER. [*Acer negundo* L.]

AGAVACEAE AGAVE FAMILY

Yucca glauca Nuttall SPANISH BAYONET.

ALISMATACEAE WATER-PLANTAIN FAMILY

Alisma triviale Pursh WATER PLANTAIN. [*A. plantago-aquatica* L. ssp. *brevipes* (Greene) Samuelsson]

ALLIACEAE ONION FAMILY
(LILIACEAE)

Allium cernuum Roth NODDING ONION.
Allium geyeri Watson WILD ONION.
Allium textile Nelson & Macbride WILD ONION.

ALSINACEAE CHICKWEED FAMILY
(CARYOPHYLLACEAE)

Cerastium fontanum Baumgartner [*C. vulgatum* L.] Adventive.
Cerastium strictum L. *emend* Haenke MOUSE-EARS. [*C. arvense* of Colorado literature]
Eremogone fendleri (Gray) Ikonnikov SANDWORT. [*Arenaria fendleri* Gray]
Paronychia jamesii Torrey & Gray JAMES' NAILWORT.
Pseudostellaria jamesiana (Torrey) Weber & Hartman TUBER STARWORT. [*Stellaria jamesiana* Torrey]

ANACARDIACEAE SUMAC FAMILY

Rhus aromatica Aiton ssp. *trilobata* (Nuttall *ex* Torrey & Gray) Weber SKUNKBRUSH. [*R. trilobata* Nutt.]
Rhus glabra L. SMOOTH SUMAC.
Toxicodendron rydbergii (Small *ex* Rydberg) Greene POISON IVY.

APIACEAE/UMBELLIFERAE PARSLEY FAMILY

Aletes acaulis (Torrey) Coulter & Rose MOUNTAIN CARAWAY.
Berula erecta (Hudson) Coville WATER PARSNIP. Adventive.
Carum carvi L. CARAWAY. Adventive. *
Conium maculatum L. POISON HEMLOCK.
Harbouria trachypleura (Gray) Coulter & Rose WHISKBROOM PARSLEY.
Heracleum sphondylium L. ssp. *montanum* (Schleicher *ex* Gaudin) Briquet in Schinz & Thellung COW PARSNIP.
Ligusticum porteri Coulter & Rose PORTER'S LOVAGE, OSHA.
Lomatium orientale Coulter & Rose SALT & PEPPER.
Musineon divaricatum (Pursh) Nuttall *ex* Torrey & Gray
Osmorhiza depauperata Philippi SWEET CICELY. [*O. obtusa* (Coulter & Rose) Fernald]
Osmorhiza longistylis (Torrey) de Candolle
Sanicula marilandica L. BLACK SNAKEROOT.

APOCYNACEAE DOGBANE FAMILY

Apocynum androsaemifolium L. SPREADING DOGBANE.

ARALIACEAE GINSENG FAMILY

Aralia nudicaulis L. WILD SARSAPARILLA.

ASCLEPIADACEAE MILKWEED FAMILY

Asclepias pumila (Gray) Vail DWARF MILKWEED.
Asclepias speciosa Torrey SHOWY MILKWEED.
Asclepias stenophylla Gray NARROW LEAVED MILKWEED.
Asclepias viridiflora Rafinesque GREEN MILKWEED.

ASPARAGACEAE ASPARAGUS FAMILY

Asparagus officinale L. ASPARAGUS. Adventive. *

ASTERACEAE/COMPOSITEAE SUNFLOWER FAMILY

Achillea lanulosa Nuttall YARROW.
Acosta diffusa (Lamarck) Sojak KNAPWEED,CORNFLOWER. [*Centaurea diffusa* Lam.] Adventive.
Agoseris aurantiaca (Hooker) Greene ORANGE FALSE DANDELION.
Agoseris glauca (Pursh) Rafinesque PALE FALSE DANDELION.
Ambrosia psilostachya De Candolle var. *coronopifolia* (Torrey & Gray) Farwell WESTERN RAGWEED. [*A. coronopifolia* T. & G.]
Ambrosia trifida L. GIANT RAGWEED. Adventive.
Antennaria howellii Greene ssp. *neodioica* (Greene) Bayer NORTHERN PUSSYTOES. [*A. neglecta* of Colorado literature; *A. obovata* Nelson] *
Antennaria parvifolia Nuttall MOUNTAIN PUSSYTOES.
Antennaria pulcherrima (Hooker) Greene ssp. *anaphaloides* (Rydberg) Weber PUSSYTOES. [*A. anaphaloides* Rydb.]
Antennaria rosea Greene PINK PUSSYTOES.
Arctium minus (Hill) Bernhardi BURDOCK. Adventive.
Arnica cordifolia Hooker HEARTLEAF ARNICA.
Arnica fulgens Pursh ORANGE ARNICA.

Artemisia frigida Willdenow SILVER SAGE.
Artemisia ludoviciana Nuttall PRAIRIE SAGE.
Aster laevis L. var. *geyeri* Gray SMOOTH ASTER.
Aster lanceolatus Willdenow ssp. *hesperius* (Gray) Semple & Chmielewski [*A. hesperius* Gray]
Aster porteri Gray PORTER'S ASTER.
Bidens frondosa L. BEGGARS TICK.
Brickellia eupatoroides (L.) Shinners BRICKELLIA. [*Kuhnia eupatoroides* L.]
Carduus nutans L. ssp. *macrolepis* (Peterman) Kazmi MUSK THISTLE. Adventive.
Chlorocrepis albiflora (Hooker) Weber WHITE HAWKWEED. [*Hieracium albiflora* Hook.]
Chrysothamnus nauseosus (Pallas *ex* Pursh) Britton ssp. *nauseosus* RABBITBRUSH.
Cichorium intybus L. CHICORY. Adventive.
Cirsium arvense (L.) Scopoli CANADA THISTLE. Adventive.
Cirsium ochrocentrum Gray
Cirsium vulgare (Savi) Tenore BULL THISTLE. [*C. lanceolatum* (L.) Scopoli] Adventive.
Dyssodia papposa (Ventenat) Hitchcock FETID MARIGOLD.
Erigeron colo-mexicanus Nelson FLEABANE.
Erigeron divergens Torrey & Gray SPREADING FLEABANE.
Erigeron flagellaris Gray WHIPLASH FLEABANE.
Erigeron speciosus (Lindley) De Candolle SHOWY FLEABANE.
Erigeron vetensis Rydberg LA VETA DAISY.
Gaillardia aristata Pursh BLANKET FLOWER.
Grindelia squarrosa (Pursh) Dunal GUMWEED.
Grindelia subalpina Greene MOUNTAIN GUMWEED.
Gutierrezia sarothrae (Pursh) Britton & Rusby SNAKEWEED.
Helianthus annuus L. COMMON SUNFLOWER.
Helianthus pumilus Nuttall SUNFLOWER.
Helianthus rigidus (Cassini) Desfontaines ssp. *subrhomboideus* (Rydberg) Heiser
Heliomeris multiflora Nuttall [*Gymnolomia multiflora* (Nutt.) Bentham & Hooker; *Viguiera multiflora* (Nutt.) Blake]
Heterotheca fulcrata (Greene) Shinners GOLDEN ASTER. [*Chrysopsis fulcrata* Greene]
Heterotheca villosa (Pursh) Shinners var. *villosa* GOLDEN ASTER. [*Chrysopsis villosa* (Pursh) Nuttall *ex* De Candolle]
Lactuca canadensis L. CANADIAN WILD LETTUCE.
Lactuca serriola L. PRICKLY LETTUCE. Adventive.
Liatris punctata Hooker BLAZING STAR.
Nothocalais cuspidata (Pursh) Greene FALSE DANDELION. [*Microseris cuspidata* (Pursh) Schultz-Bipontinus]
Oligoneuron rigidum (L.) Small STIFF GOLDENROD. [*Solidago rigida* L.]
Oligosporus dracunculus (L.) Poljakov WILD TARRAGON. [*Artemisia dracunculoides* Pursh]
Oligosporus pacificus (Nuttall) Poljakov WESTERN SAGEWORT. [*O. campestris* (L.) ssp. *pacificus* (Nutt.) Weber; *Artemisia campestris* L.; *A. pacifica* Nutt.]
Oreochrysum parryi (Gray) Rydberg PARRY GOLDENROD. [*Haplopappus parryi* Gray]
Packera fendleri (Gray) Weber & Löve FENDLER'S SENECIO. [*Senecio fendleri* Gray]
Packera plattensis (Nuttall) Weber & Löve [*Senecio plattensis* Nutt.]
Pericome caudata Gray var. *caudata*
Podospermum laciniatum (L.) De Candolle FALSE SALSIFY. [*Scorzonera laciniata* L.]
Psilochenia occidentalis (Nuttall) Nuttall WESTERN HAWKSBEARD. [*Crepis occidentalis* Nutt.] *
Ratibida columnifera (Nuttall) Wooton & Standley PRAIRIE CONEFLOWER.
Rudbeckia ampla Nelson TALL CONEFLOWER. [*R. laciniata* L. var. *ampla* (Nelson) Cronquist]
Senecio integerrimus Nuttall SPRING SENECIO.
Senecio spartioides Torrey & Gray BROOM SENECIO.
Solidago missouriensis Nuttall SMOOTH GOLDENROD.
Solidago nana Nuttall LOW GOLDENROD.

Solidago nemoralis Aiton WOODLAND GOLDENROD.
Taraxacum officinale G.H. Weber COMMON DANDELION. Adventive.
Townsendia grandiflora Nuttall SHOWY EASTER DAISY.
Townsendia hookeri Beaman
Tragopogon dubius Scopoli ssp. *major* (Jacquin) Vollmann SALSIFY. Adventive.
Tragopogon porrifolius L. Adventive.
Virgulus falcatus (Lindley) Reveal & Keener [*Aster falcatus* Lindley]
Xanthium strumarium L. COCKLEBUR. Adventive.

BERBERIDACEAE BARBERRY FAMILY

Mahonia repens (Lindley) Don OREGON GRAPE.

BETULACEAE BIRCH FAMILY

Alnus incana (L.) Moench ssp. *tenuifolia* (Nuttall) Breitung ALDER. [*A. tenuifolia* Nutt.]
Betula fontinalis Sargent RIVER BIRCH. [*B. occidentalis* Hooker]
Corylus cornuta Marshall HAZLENUT.

BORAGINACEAE BORAGE FAMILY

Asperugo procumbens L. MADWORT. Adventive.
Cynoglossum officinale L. HOUND'S TONGUE. Adventive.
Hackelia floribunda (Lehmann) Johnston STICKSEED.
Lappula redowskii (Hornemann) Greene BEGGARS TICK.
Lithospermum incisum Lehmann NARROW-LEAVED PUCCOON.
Lithospermum multiflorum Torrey *ex* Gray MANY-FLOWERED PUCCOON.
Mertensia ciliata (James *ex* Torrey) Don BLUEBELLS.
Mertensia lanceolata (Pursh) De Candolle var. *lanceolata* BLUEBELLS.
Myosotis scorpioides L. FORGET-ME-NOT. Adventive.
Onosmodium molle Michaux ssp. *occidentale* (Mackenzie) Cochrane FALSE GROMWELL.
Oreocarya virgata (Porter) Greene MINER'S CANDLE. [*Cryptantha virgata* (Porter) Payson]

BRASSICACEAE/CRUCIFERAE MUSTARD FAMILY

Alyssum alyssoides L. ALYSSUM. Adventive.
Alyssum parviflorum Bieberstein ALYSSUM. [*A. minus* (L.) Rothmaler] Adventive.
Arabis hirsuta (L.) Scopoli HAIRY ROCK CRESS.
Barbarea orthoceras Ledebour WINTERCRESS. Adventive.
Boechera fendleri (Watson) Weber FENDLER'S ROCK CRESS. [*Arabis fendleri* Watson]
Camelina microcarpa Andrzejowski FALSE FLAX. Adventive.
Capsella bursa-pastoris (L.) Medicus SHEPHERDS PURSE. Adventive.
Cardaria cf. *draba* (L.) Desvaux WHITETOP. Adventive.
Chorispora tenella (Pallas) DeCandolle PURPLE MUSTARD. Adventive.
Descurainia incana (Bernardhi *ex* Fischer & Meyer) Dorn WESTERN TANSY MUSTARD. [*D. richardsonii* (Sweet) Schultz]
Erysimum capitatum (Douglas) Greene WESTERN WALLFLOWER.
Lepidium virginicum L. PEPPERGRASS. Adventive.
Lesquerella montana (Gray) Watson MOUNTAIN BLADDER-POD.
Neolepia campestre (L.) Weber FIELD CRESS. [*Lepidium campestre* (L.) R.Brown] Adventive.
Noccaea montana (L.) Meyer WILD CANDYTUFT. [*Thlaspi montanum* L.]
Sisymbrium altissimum L. JIM HILL MUSTARD. Adventive.
Thlaspi arvense L. PENNY CRESS. Adventive.

Turritis glabra L. TOWER MUSTARD. [*Arabis glabra* (L.) Bernhardi] Adventive.

CACTACEAE CACTUS FAMILY

Coryphantha missouriensis (Sweet) Britton & Rose NIPPLE CACTUS. [*Mammillaria missouriensis* Sweet]
Echinocereus viridiflorus Engelmann GREEN FLOWERED HEDGEHOG CACTUS.
Opuntia fragilis (Nuttall) Haworth BRITTLE CACTUS.
Opuntia macrorhiza Engelmann PRICKLY PEAR CACTUS. [*O. compressa* (Salisbury) Macbride]
Pediocactus simpsonii (Engelmann) Britton & Rose MOUNTAIN BALL CACTUS.

CALOCHORTACEAE MARIPOSA FAMILY
(LILIACEAE)

Calochortus gunnisonii Watson MARIPOSA LILY.

CAMPANULACEAE BELL FLOWER FAMILY

Campanula rotundifolia L. HAREBELL.

CANNABACEAE HOPS FAMILY

Humulus lupulus L. ssp. *americanus* (Nuttall) Löve & Löve WILD HOPS. [*H. americanus* Nutt.]

CAPRIFOLIACEAE HONEYSUCKLE FAMILY

Symphoricarpos albus (L.) Blake WHITE SNOWBERRY.
Symphoricarpos occidentalis Hooker WESTERN SNOWBERRY.
Viburnum lentago L. NANNYBERRY. Adventive.

CARYOPHYLLACEAE PINK FAMILY
(see also ALSINACEAE)

Gastrolychnis drummondii (Hooker) Löve & Löve CAMPION. [*Lychnis drummondii* (Hook.) Watson]

CHENOPODIACEAE GOOSEFOOT FAMILY

Bassia sieversiana (Pallas) Weber BURNING BUSH. [*Kochia iranica* of the Colorado literature] Adventive.
Chenopodium fremontii Watson
Chenopodium leptophyllum (Nuttall *ex* Moquin) Watson

COMMELINACEAE SPIDERWORT FAMILY

Tradescantia occidentalis (Britton) Smyth var. *scopulorum* (Rose) Anderson & Woodson SPIDERWORT.

CONVALLARIACEAE MAYFLOWER FAMILY
(LILIACEAE)

Maianthemum amplexicaule (Nuttall) Weber FALSE SOLOMON'S SEAL. [*Smilacina racemosa* of the Colorado literature]
Maianthemum stellatum (L.) Link FALSE SOLOMON'S SEAL. [*Smilacina stellata* (L.) Desfontaines]

CONVOLVULACEAE MORNINGGLORY FAMILY

Convolvulus arvensis L. BINDWEED. Adventive.

COPTACEAE MEADOW RUE FAMILY
(RANUNCULACEAE)

Thalictrum fendleri Engelmann *ex* Gray MEADOW RUE.

CORNACEAE DOGWOOD FAMILY

Swida sericea (L.) Holub RED OSIER DOGWOOD. [*Cornus stolonifera* Michaux]

CRASSULACEAE STONECROP FAMILY

Amerosedum lanceolatum (Torrey) Löve & Löve STONECROP. [*Sedum lanceolatum* Torrey]

CYPERACEAE SEDGE FAMILY

Carex brevior (Dewey) Mackenzie
Carex lanuginosa Michaux
Carex microptera Mackenzie [*C. festiva* Dewey]
Carex nebrascensis Dewey
Carex occidentalis Bailey
Carex pensylvanica Lamarck ssp. *heliophila* (Mackenzie) Weber [*C.heliophila* Mackenzie]
Carex praegracilis Boott
Carex scoparia Schkuhr *ex* Willdenow
Carex stenophylla Wahlenberg ssp. *eleocharis* (Bailey) Hultén [*C. eleocharis* Bailey]
Carex stipata Mühlenberg *ex* Willdenow
Carex vulpinoidea Michaux
Eleocharis palustris (L.) Roemer & Schultes SPIKE RUSH. [*E. macrostachya* Britton]
Scirpus microcarpus Presl BULRUSH. [*S. rubrotinctus* Fernald]
Scirpus pallidus (Britton) Fernald BULRUSH.

ELAEAGNACEAE OLEASTER FAMILY

Elaeagnus angustifolia L. RUSSIAN OLIVE. Adventive.

ERICACEAE HEATH FAMILY
(see also MONOTROPACEAE, PYROLACEAE)

Arctostaphylos uva-ursi (L.) Sprengel ssp. *adenotricha* (Fernald & Macbride) Calder & Taylor KINNIKINNIK, BEARBERRY.

EUPHORBIACEAE SPURGE FAMILY

Agaloma marginata (Pursh) Löve & Löve SNOW-ON-THE-MOUNTAIN. [*Euphorbia marginata* Pursh]
Chamaesyce serpyllifolia (Persoon) Small [*Euphorbia serpyllifolia* Pers.] Adventive. *
Poinsettia dentata (Michaux) Klotsch & Garcke [*Euphorbia dentata* Michx.] *
Tithymalus brachyceras (Engelmann) Small ROCKY MT. SPURGE. [*T. montanus* (Engelm.) Sm.; *Euphorbia robusta* of Colorado literature]
Tragia ramosa (Müller-Argoviensis) Torrey STINGING SPURGE.

FABACEAE/LEGUMINOSAE PEA FAMILY

Amorpha fruticosa L. LEAD PLANT.
Amorpha nana Nuttall DWARF AMORPHA.
Astragalus adsurgens Pallas var. *robustior* Hooker [*A.striatus* Nuttall *ex* Torrey & Gray]
Astragalus agrestis Douglas *ex* Don [*A. dasyglottis* of Colorado literature]
Astragalus crassicarpus Nuttall GROUND PLUM.
Astragalus drummondii Douglas *ex* Hooker DRUMMOND'S MILK VETCH.
Astragalus flexuosus (Hooker) Don WIRY MILK VETCH.
Astragalus shortianus Nuttall in Torrey & Gray
Astragalus tenellus Pursh LOOSE FLOWERED MILK VETCH.
Dalea candida Willdenow var. *oligophylla* (Torrey) Shinners WHITE PRAIRIE CLOVER.
Dalea purpurea Ventenat PURPLE PRAIRIE CLOVER.
Glycyrrhiza lepidota Pursh WILD LICORICE.
Lathyrus leucanthus Rydberg WHITE FLOWERED PEAVINE.
Lotus tenuis Waldstein & Kitaibel BIRDSFOOT TREFOIL. Adventive.
Lupinus argenteus Pursh COMMON LUPINE.
Medicago lupulina L. BLACK MEDIC. Adventive.
Medicago sativa L. ALFALFA. Adventive.
Melilotus albus Medicus WHITE SWEET CLOVER. Adventive.
Melilotus officinalis (L.) Pallas YELLOW SWEET CLOVER. Adventive.
Oxytropis lamberti Pursh COLORADO LOCO.
Psoralidium tenuiflora (Pursh) Rydberg [*Psoralea tenuiflora* Pursh]
Thermopsis divaricarpa Nelson GOLDEN BANNER.
Trifolium fragiferum L. STRAWBERRY CLOVER. Adventive.
Trifolium pratense L. RED CLOVER. Adventive.
Trifolium repens L. WHITE DUTCH CLOVER. Adventive.
Vicia americana Mühlenberg AMERICAN VETCH.

FUMARIACEAE FUMITORY FAMILY

Corydalis aurea Willdenow ssp. *aurea* GOLDEN SMOKE.

GENTIANACEAE GENTIAN FAMILY

Frasera speciosa Douglas *ex* Grisebach MONUMENT PLANT, GREEN GENTIAN.
Pneumonanthe affinis (Grisebach) Greene BOTTLE GENTIAN. [*Gentiana affinis* Gris. in Hooker]

GERANIACEAE GERANIUM FAMILY

Erodium cicutarium (L.) L'Heritier STORKSBILL. Adventive.
Geranium caespitosum James COMMON GERANIUM.

GROSSULARIACEAE CURRANT or GOOSEBERRY FAMILY

Ribes aureum Pursh GOLDEN CURRANT.
Ribes cereum Douglas WAX CURRANT.
Ribes inerme Rydberg COMMON GOOSEBERRY.

HELLEBORACEAE HELLEBORE FAMILY
(RANUNCULACEAE)

Delphinium carolinianum Walter ssp. *virescens* (Nuttall) Johnston PLAINS LARKSPUR. [*D. virescens* Nutt.]
Delphinium nuttallianum Pritzel BLUE LARKSPUR. [*D. nelsonii* Greene]

HYDRANGEACEAE HYDRANGEA FAMILY

Jamesia americana Torrey & Gray WAXFLOWER.

HYDROPHYLLACEAE WATERLEAF FAMILY

Hydrophyllum fendleri (Gray) Heller WATERLEAF.
Phacelia heterophylla Pursh SCORPION WEED.

HYPERICACEAE ST. JOHNSWORT FAMILY

Hypericum perforatum L. KLAMATH WEED. Adventive.

IRIDACEAE IRIS FAMILY

Iris missouriensis Nuttall WILD IRIS.
Sisyrinchium montanum Greene BLUE-EYED-GRASS.

JUNCACEAE RUSH FAMILY

Juncus arcticus Willdenow ssp. *ater* (Rydb.) Hultén
Juncus articulatus L. Adventive.
Juncus bufonius L. TOAD RUSH.
Juncus compressus Jacquin Adventive.
Juncus confusus Coville
Juncus dudleyi Wiegand [*J. tenuis* Willdenow] *
Juncus longistylis Torrey
Juncus saximontanus Nelson
Luzula parviflora (Ehrhart) Desvaux WOOD RUSH.

LAMIACEAE/LABIATAE MINT FAMILY

Lycopus americanus Mühlenberg *ex* Barton WATER HOREHOUND.
Mentha arvensis L. FIELD MINT.
Monarda fistulosa L. var. *menthifolia* (Graham) Fernald PINK BERGAMOT.
Nepeta cataria L. CATNIP. Adventive.
Prunella vulgaris L. HEAL-ALL.
Salvia reflexa Hornemann LANCE LEAVED SAGE. Adventive.
Scutellaria brittonii Porter BRITTON SKULLCAP.
Teucrium canadense L. var. *occidentalis* GERMANDER.

LEMNACEAE DUCKWEED FAMILY

Lemna minor L. DUCKWEED.

LILIACEAE LILY FAMILY
(see also ALLIACEAE, CONVALLARIACEAE, CALOCHORTACEAE, MELIANTHIACEAE, and UVULARIACEAE)

Leucocrinum montanum Nuttall *ex* Torrey & Gray SAND LILY.

LINACEAE FLAX FAMILY

Adenolinum lewisii (Pursh) Löve & Löve WILD FLAX. [*Linum lewisii* Pursh]

MALVACEAE MALLOW FAMILY

Malva neglecta Wallroth MALLOW. Adventive.
Sphaeralcea coccinea (Pursh) Rydberg COPPER MALLOW.

MELANTHIACEAE FALSE HELLEBORE FAMILY
(LILIACEAE)

Toxicoscordion venenosum (Watson) Rydberg DEATH CAMAS. [*Zigadenus gramineus* Rydb.; *Z. venenosus* Watson]

NYCTAGINACEAE FOUR O'CLOCK FAMILY

Oxybaphus hirsutus (Pursh) Sweet in De Candolle HAIRY UMBRELLAWORT. [*Mirabilis hirsuta* (Pursh) MacMillan]
Oxybaphus linearis (Pursh) Robinson NARROW LEAVED UMBRELLAWORT. [*Mirabilis linearis* (Pursh) Heimerl]

ONAGRACEAE EVENING-PRIMROSE FAMILY

Calylophus serrulatus (Nuttall) Raven [*Oenothera serrulata* Nutt.]
Chamerion danielsii Löve FIREWEED. [*C. angustifolium* and/or *Epilobium angustifolium* of Colorado literature]
Circaea alpina L. ssp. *pacifica* (Ascherson & Magnus) Raven ENCHANTERS NIGHTSHADE.
Epilobium brachycarpum Presl ANNUAL WILLOW HERB. [*E. paniculatum* Nuttall]
Epilobium ciliatum Rafinesque ssp. *glandulosum* (Lehmann) Hoch & Raven NORTHERN WILLOW HERB. [*E. adenocaulon* Haussknecht]
Gaura coccinea Nuttall *ex* Pursh SCARLET GAURA.
Gaura parviflora Douglas *ex* Lehmann
Oenothera villosa Thunberg ssp. *strigosa* (Rydberg) Dietrich & Raven COMMON EVENING PRIMROSE. [*O. strigosa* (Rydberg) Mackenzie & Bush]

ORCHIDACEAE ORCHID FAMILY

Corallorhiza maculata Rafinesque SPOTTED CORAL ROOT.
Corallorhiza striata Lindley STRIPED CORAL ROOT.
Corallorhiza wisteriana Conrad SPRING CORAL ROOT.

OROBANCHACEAE BROOMRAPE FAMILY

Aphyllon fasciculatum (Nuttall) Torrey & Gray BROOMRAPE. [*Orobanche fasciculata* Nutt.]
Aphyllon uniflorum (L.) Torrey & Gray BROOMRAPE. [*Orobanche uniflora* L.]

OXALIDACEAE WOOD SORREL FAMILY

Oxalis dillenii Jacquin WOOD SORREL.

PAPAVERACEAE POPPY FAMILY

Argemone polyanthemos (Fedde) Ownbey PRICKLY POPPY. [*A. intermedia* Sweet]
Papaver orientale L. ORIENTAL POPPY. Adventive.

PLANTAGINACEAE PLANTAIN FAMILY

Plantago lanceolata L. ENGLISH PLANTAIN. Adventive.
Plantago major L. COMMON PLANTAIN. Adventive.

POACEAE/GRAMINEAE GRASS FAMILY

Agropyron cristatum (L.) Gaertner ssp. *desertorum* (Fischer) Löve & Löve CRESTED WHEAT GRASS. [*A. desertorum* (Fisch.) Schultes] Adventive.
Agrostis gigantea Roth RED TOP. Adventive.
Andropogon gerardii Vitman BIG BLUESTEM.
Anisantha tectorum (L.) Nevski CHEAT GRASS. [*Bromus tectorum* L.] Adventive.
Aristida purpurea Nuttall THREE AWN. [Including *A. fendleriana* Steudel, *A. harvardii* Vasey, *A. longiseta* Steudel, *A. wrightii* Nash]
Arrhenatherum elatius (L.) Presl TALL OAT GRASS. Adventive.
Bouteloua curtipendula (Michaux) Torrey SIDE-OATS GRAMA.
Bromopsis inermis (Leysser) Holub SMOOTH BROME. [*Bromus inermis* Leysser] Adventive.
Bromopsis lanatipes (Shear) Holub BROME. [*Bromus lanatipes* Shear; *B. anomalus* Ruprecht *ex* Fournier var *lanatipes*]
Bromus briziformis Fischer & Meyer RATTLESNAKE GRASS. Adventive.
Bromus japonicus Thunberg JAPANESE BROME. Adventive.
Buchloë dactyloides (Nuttall) Engelmann BUFFALO GRASS.
Ceratochloa carinata (Hooker & Arnott) Tutin RESCUE GRASS. [*Bromus carinatus* Hook. & Arnott]
Chondrosum gracile Humboldt, Bonpland, & Kunth BLUE GRAMA. [*Bouteloua gracilis* (H.B.& K.) Lagasca *ex* Griffiths]
Chondrosum hirsutum (Lagasca) Sweet HAIRY GRAMA. [*Bouteloua hirsuta* Lag.]
Critesion jubatum (L.) Nevski FOXTAIL BARLEY. [*Hordeum jubatum* L.]
Cylindropyrum cylindricum (Host) Löve GOAT GRASS. [*Aegilops cylindrica* Host] Adventive.
Dactylis glomerata L. ORCHARD GRASS. Adventive.
Danthonia spicata (L.) Beauvois POVERTY OAT GRASS.
Elymus canadensis L. CANADA WILD RYE.
Elymus glaucus Buckley BLUE WILD RYE.
Elymus longifolius (Smith) Gould SQUIRREL TAIL. [*Sitanion longifolium* Smith]
Elymus trachycaulus (Link) Gould SLENDER WHEATGRASS. [*Agropyron trachycaulum* (Link) Malte]
Elytrigia repens (L.) Nevski QUACK GRASS. [*Agropyron repens* (L.) Beauvois] Adventive.
Festuca pratensis Hudson MEADOW FESCUE. [*F. elatior* L.] Adventive.
Glyceria elata (Nash *ex* Rydberg) Hitchcock TALL MANNA GRASS.
Glyceria striata (Lamarck) Hitchcock FOWL MANNA GRASS.
Koeleria macrantha (Ledebour) Schultes JUNE GRASS. [*K. cristata* (L.) Persoon, *K. gracilis* Pers.]
Leucopoa kingii (Watson) Weber SPIKE FESCUE. [*Hesperochloa kingii* (Watson) Rydberg]
Leymus ambiguus (Vasey & Scribner) Dewey COLORADO WILD RYE. [*Elymus ambiguus* Vasey & Scribner]
Muhlenbergia asperifolia (Nees & Meyen *ex* Trinius) Parodi ALKALI MUHLY.
Muhlenbergia montana (Nuttall) Hitchcock MOUNTAIN MUHLY.
Muhlenbergia wrightii Vasey SPIKE MUHLY.

Oryzopsis micrantha (Trinius & Ruprecht) Thurber LITTLESEED RICEGRASS.
Panicum virgatum L. SWITCHGRASS.
Pascopyrum smithii (Rydberg) Löve WESTERN WHEATGRASS. [*Agropyron smithii* Rydberg]
Phalaroides arundinacea (L.) Rauschert REED CANARY GRASS. [*Phalaris arundinacea* L.] Adventive.
Phleum pratense L. TIMOTHY. Adventive.
Poa agassizensis Boivin & D. Löve BLUEGRASS.
Poa bulbosa L. BULBOUS BLUEGRASS.
Poa compressa L. CANADA BLUEGRASS. Adventive(?).
Poa nemoralis L. ssp. *interior* (Rydberg) Butters & Abbe [*P. interior* Rydb.]
Poa pratensis L. KENTUCKY BLUEGRASS. Adventive.
Puccinellia airoides Watson & Coulter ALKALI GRASS. [*P. nuttalliana* of literature]
Schizachyrium scoparium (Michaux) Nash LITTLE BLUESTEM. [*Andropogon scoparius* Michaux]
Sorghastrum avenaceum (Michaux) Nash INDIAN GRASS. [*S. nutans* (L.) Nash]
Sporobolus heterolepis (Gray) Gray PRAIRIE DROPSEED.
Stipa comata Trinius & Ruprecht NEEDLE-AND-THREAD.
Stipa nelsonii Scribner NEEDLEGRASS. [*S. columbiana* Macoun]
Stipa viridula Trinius GREEN NEEDLEGRASS.
Thinopyrum intermedium (Host) Barkworth & Dewey WHEAT GRASS. [*Agropyron intermedium* (Host) Beauvois; *Elytrigia intermedia* (Host) Nevski] Adventive.
Vulpia octoflora (Walter) Rydberg SIX WEEKS FESCUE. [*Festuca octoflora* Walt.]

POLEMONIACEAE PHLOX FAMILY

Collomia linearis Nuttall NARROWLEAVED COLLOMIA.
Ipomopsis aggregata (Pursh) Grant ssp. *candida* (Rydberg) Grant & Grant GILIA. [*Gilia candida* Rydb.; *I. candida* (Rydb.) Wherry]
Ipomopsis spicata (Nuttall) Grant SPIKE GILIA. [*Gilia spicata* Nutt.]
Microsteris gracilis (Douglas *ex* Hooker) Greene ssp. *humilis* (Greene) Grant [*M. humilis* (Doug. *ex* Hook.) Greene]
Phlox multiflora Nelson MANY-FLOWERED PHLOX.

POLYGONACEAE BUCKWHEAT FAMILY

Acetosella vulgaris (Koch) Fourreau SHEEP SORREL. [*Rumex acetosella* L.] Adventive.
Eriogonum effusum Nuttall
Eriogonum jamesii Bentham var. *flavescens* Watson *
Eriogonum umbellatum Torrey SULPHUR FLOWER.
Polygonum arenastrum Boreau DEVIL'S SHOESTRING. [*P. aviculare, P. rurivagum* of many authors] Adventive.
Polygonum douglasii Greene DOUGLAS KNOTWEED. [*P. montanum* (Small) Greene, *P. sawatchense* Small]
Pterogonum alatum (Torrey) Gross WINGED BUCKWHEAT. [*Eriogonum alatum* Torrey]
Rumex crispus L. CURLY DOCK. Adventive.

PORTULACEAE PURSLANE FAMILY

Claytonia rosea Rydberg SPRING BEAUTY. [*C. lanceolata* Pursh]

PRIMULACEAE PRIMROSE FAMILY

Androsace septentrionalis L. ROCK PRIMROSE.
Dodecatheon pulchellum (Rafinesque) Merrill SHOOTING STAR.
Lysimachia ciliata L. FRINGED LOOSESTRIFE. [*Steironema ciliatum* (L.) Rafinesque] *

PYROLACEAE WINTERGREEN FAMILY

Chimaphila umbellata (L.) Barton ssp. *occidentalis* (Rydberg) Hultén PIPSISSEWA.

RANUNCULACEAE BUTTERCUP FAMILY
(see also COPTACEAE and HELLEBORACEAE)

Anemone cylindrica Gray THIMBLEWEED.
Atragene occidentalis Hornemann BLUE CLEMATIS. [*Clematis occidentalis* (Hornemann) DeCandolle, *C. columbiana* of Colorado literature]
Batrachium circiniatum (Sibthorp) Fries WATER CROWFOOT. [*Ranunculus circiniatus* Sib.]
Clematis ligusticifolia Nuttall VIRGIN'S BOWER.
Coriflora hirsutissima (Pursh) Weber SUGARBOWLS. [*Clematis hirsutissima* Pursh]
Pulsatilla patens (L.) Miller ssp. *multifida* (Pritzel) Zamels PASQUE FLOWER. [*P. ludoviciana* (Nuttall) Heller; *Anemone patens* L.]
Ranunculus abortivus L. ssp. *acrolasius* (Fernald) Kapoor SMALL FLOWERED CROWFOOT.
Ranunculus macounii Britton MACOUN'S BUTTERCUP.

RHAMNACEAE BUCKTHORN FAMILY

Ceanothus fendleri Gray BUCKBRUSH.
Ceanothus herbaceus Rafinesque REDROOT. [*C. ovatus* Desfontaines]
Ceanothus velutinus Douglas *ex* Hooker STICKY LAUREL.

ROSACEAE ROSE FAMILY

Agrimonia striata Michaux AGRIMONY.
Amelanchier alnifolia Nuttall SERVICEBERRY.
Cerasus pennsylvanica (L.) Loiseleur PIN CHERRY. [*Prunus pennsylvanica* L.]
Cercocarpus montanus Rafinesque MOUNTAIN-MAHOGONY.
Crataegus macracantha Loddiges var. *occidentalis* (Britton) Eggleston HAWTHORN. [*C. succulenta* of Colorado literature]
Drymocallis fissa (Nuttall) Rydberg [*Potentilla fissa* Nutt.]
Fragaria vesca L. ssp. *bracteata* (Heller) Staudt STRAWBERRY. [*F. americana* (Porter) Britton]
Geum aleppicum Jacquin ssp. *strictum* (Aiton) Clausen YELLOW AVENS. [*G. strictum* Aiton]
Holodiscus dumosus (Hooker) Heller OCEANSPRAY.
Malus domestica Borkhausen APPLE. [*M. pumila* Miller]
Oreobatus deliciosus (James) Rydberg BOULDER RASPBERRY. [*Rubus deliciosus* James]
Padus virginiana (L.) Miller ssp. *melanocarpa* (Nelson) Weber CHOKECHERRY. [*Prunus virginiana* L.]
Physocarpus monogynus (Torrey) Coulter NINEBARK.
Potentilla hippiana Lehmann WOOLY CINQUEFOIL.
Potentilla pensylvanica L. PRAIRIE CINQUEFOIL.
Potentilla recta L. Adventive.
Prunus americana Marshall WILD PLUM.
Rosa woodsii Lindley WILD ROSE.
Rubus idaeus L. ssp. *melanolasius* (Dieck) Focke WILD RASPBERRY.

RUBIACEAE MADDER FAMILY

Galium aparine L. CLEAVERS. Adventive.
Galium septentrionale Roemer & Schultes NORTHERN BEDSTRAW. [*G. boreale* of Colorado literature]

SALICACEAE WILLOW FAMILY

Populus acuminata Rydberg
Populus angustifolia James NARROWLEAF COTTONWOOD.
Populus deltoides Marshall ssp. *monilifera* (Aiton) Eckenwalder PLAINS COTTONWOOD. [*P.sargentii* Dode]
Populus tremuloides Michaux ASPEN.
Salix amygdaloides Andersson PEACH LEAVED WILLOW.
Salix bebbiana Sargent BEAKED WILLOW. [*S.depressa* of Colorado literature]
Salix exigua Nuttall SANDBAR WILLOW.
Salix fragilis L. CRACK WILLOW. Adventive.
Salix irrorata Andersson BLUESTEM WILLOW.

SANTALACEAE SANDALWOOD FAMILY

Comandra umbellata (L.) Nuttall ssp. *pallida* (De Candolle) Piehl BASTARD TOADFLAX. [*C. pallida* DC]

SAXIFRAGACEAE SAXIFRAGE FAMILY

Ciliaria austromontana (Weigand) Weber SPOTTED SAXIFRAGE. [*Saxifraga bronchialis* L. ssp. *austromontana* (Weig.) Piper]
Heuchera bracteata (Torrey) Seringe BRACTED ALUM ROOT.
Heuchera parvifolia Nuttall *ex* Torrey & Gray COMMON ALUM ROOT.
Micranthes rhomboidea (Greene) Small SNOWBALL SAXIFRAGE. [*Saxifraga rhomboidea* Greene]

SCROPHULARIACEAE FIGWORT FAMILY

Castilleja linariifolia Bentham in De Candolle WYOMING PAINTBRUSH.
Castilleja miniata Douglas *ex* Hooker SCARLET PAINTBRUSH.
Castilleja sessiliflora Pursh PLAINS PAINTBRUSH.
Collinsia parviflora Douglas in Lindley BABY-BLUE-EYES.
Digitalis purpurea L. FOXGLOVE. Adventive.
Linaria genistifolia (L.) Miller ssp. *dalmatica* (L.) Maire BUTTER AND EGGS. [*L. dalmatica* (L.) Miller] Adventive.
Mimulus glabratus H.B.K. SMOOTH MONKEY FLOWER.
Penstemon glaber Pursh SMOOTH PENSTEMON. [*P.alpinus* Torrey]
Penstemon gracilis Nuttall SLENDER PENSTEMON.
Penstemon secundiflorus Bentham in De Candolle ONE-SIDED PENSTEMON.
Penstemon virens Pennell *ex* Rydberg LOW PENSTEMON.
Penstemon virgatus Gray ssp. *asa-grayi* Crosswhite
Scrophularia lanceolata Pursh FIGWORT.
Verbascum thapsus L. MULLEIN. Adventive.
Veronica americana Schweintz *ex* Bentham AMERICAN BROOKLIME.
Veronica catenata Pennell Adventive.

SMILACACEAE SMILAX FAMILY

Smilax lasioneuron Hooker CARRION FLOWER. [*S. herbacea* L. var. *lasioneuron* (Hook.) De Candolle]

SOLANACEAE NIGHTSHADE FAMILY

Solanum rostratum Dunal BUFFALO BUR. Adventive.

TYPHACEAE CATTAIL FAMILY

Typha latifolia L. BROAD LEAVED CATTAIL.

ULMACEAE ELM FAMILY

Celtis reticulata Torrey HACKBERRY. [*C. occidentalis* L.]
Ulmus pumila L. SIBERIAN ELM. Adventive.

URTICACEAE NETTLE FAMILY

Parietaria pensylvanica Mühlenberg *ex* Willdenow PELLITORY.
Urtica gracilis Aiton STINGING NETTLE. [*U.dioica* L. var. *gracilis* Aiton; *U. gracilenta* Greene]

VERBENACEAE VERVAIN FAMILY

Phyla cuneifolia (Torrey) Greene FOG FRUIT. *
Verbena bracteata Lagasca & Rodriguez VERVAIN. Adventive.

VIOLACEAE VIOLET FAMILY

Viola nuttallii Pursh YELLOW VIOLET.
Viola pedatifida Don BIRDFOOT VIOLET.
Viola rydbergii Greene [*V.rugulosa* and *V.canadensis* of the Colorado literature]
Viola scopulorum (Gray) Greene [*V.canadensis* L. var. *scopulorum* Gray]

VISCACEAE DWARF MISTLETOE FAMILY

Arceuthobium vaginatum (Willdenow) Presl MISTLETOE.

VITACEAE GRAPE FAMILY

Vitis riparia Michaux WILD GRAPE. [*V. vulpina* of the Colorado literature]

ZYGOPHYLLACEAE CALTROP FAMILY

Tribulus terrestris L. PUNCTURE VINE. Adventive. *

Floristic Summary

Families 92
Genera 302
Species 428
Adventives 83

Asteraceae 70 spp.
Poaceae 52
Fabaceae 26
Rosaceae 19
Brassicaceae 18