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OSMP Studies
Mule Deer Study: Progress Report 1983
OSMP Studies 4279
Study 
Western Resource Development C



MULE DEER STUDY

PROGRESS REPORT

prepared for

City of Boulder
Parks & Recreation Department
P.O. Box 791 Boulder, Colorado 80306

prepared by

Western Resource Development Corporation
711 Walnut Street P.O. Box 467 Boulder, Colorado 80306

August 1983

TABLE A-2

MULE DEER TAGGED AND MARKED IN THE NORTH SUBUNIT
OF THE CITY OF BOULDER MOUNTAIN PARKS AND OPEN SPACE LAND, 1983

<u>Date Tagged</u>	<u>Sex</u>	<u>Age</u>	<u>Eartag (orange)</u>		<u>Neckband Color/Number</u>	<u>Remarks</u>
			<u>Left</u>	<u>Right</u>		
1/31/83	F	Ad	31	31		
1/31/83	F	Fn	32	32		
2/ 1/83	M	Ad	39	39		
2/ 2/83	M	Ad	34	34		
2/ 2/83	M	Ad	35	35		
3/ 4/83	F	Fn	63	63		
2/ 5/83	M	Ad	38	38		
2/ 5/83	M	Yr1	41	41		
3/ 4/83	F	Ad	61	61	Orange 900	148.900
2/15/83	M	Ad	47	47		
2/15/83	M	Ad	43	43		
2/16/83	F	Ad	46	46		
2/16/83	F	Ad	36	36	Orange 640	148.640 3/3/83 antlers in velvet
2/18/83	M	Ad	37	37		
2/21/83	M	Ad	48	48		
2/21/83	F	Ad	45	45		
2/22/83	M	Ad	49	49		
2/22/83	M	Ad	50	50		
2/23/83	F	Ad	44	44	Orange 600	148.600 3/2/83
2/23/83	M	Fn	51	51		
2/23/83	M	Ad	52	52		
2/24/83	M	Fn	53	53		
2/24/83	F	Ad	54	54		
2/24/83	M	Fn	55	55		
2/25/83	F	Ad	58	58		
2/26/83	F	Fn	57	57		
2/27/83	M	Ad	59	59		
2/28/83	F	Ad	60	60	690	148.690
2/25/83	M	Ad	56	56		
2/12/83	F	Ad	42	42		



**WESTERN
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August 11, 1983

Ms. Stephanie Berry
Real Estate/Open Space
City of Boulder
1777 Broadway
Boulder, CO 80302

Dear Ms. Berry:

The enclosed report on the mule deer study summarizes progress to date and discusses plans for the next phase of the study.

The report discusses and provides information on trapping and marking results, deer movement, deer/vehicle collisions, and population estimates. When the next phase of work is completed we will further define the population estimates and movement patterns, assess mule deer fidelity to park areas, estimate the total population that moves into the city, and identify deer/auto problem sites.

We sincerely thank you for this opportunity to provide professional ecological services to the City of Boulder. We look forward to another year of productive association with the professionals in Real Estate/Open Space and other City government units.

Sincerely,

David

David L. Johnson
President

DLJ:ei
Enclosure

MULE DEER STUDY

PROGRESS REPORT

prepared for

City of Boulder, Parks & Recreation Department
P. O. Box 791, Boulder, Colorado 80306

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711 Walnut Street, P. O. Box 467, Boulder, Colorado 80306

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INTRODUCTION

This progress report summarizes work completed to date by Western Resource Development Corporation (WRD) on the mule deer study for the City of Boulder. The information contained within this report is only a preliminary analysis of the data gathered during the first season. A final report and complete analysis of all data collected during both years of the study will be provided in July 1984.

METHODS

Deer were trapped during January, February, and March 1983 in clover traps (Clover 1956) located throughout the study area. Traps were baited with pieces of livestock salt block, alfalfa hay, and apple mash or crushed apples. Crushed apples were the most effective bait. Traps were placed to obtain a representative sample of the population. Some potential trap sites were eliminated due to their proximity to houses and heavily used recreational areas.

All deer were manually handled by a crew of 3-4 persons. No tranquilizer drugs were used. Initially, all deer were marked with soft plastic duo colored neck collars and a small eartag in the right ear. Because of potential problems with deer catching their legs in the collars, fawns outgrowing their collars, and the necks of bucks swelling larger than the collar during rut, use of collared neckbands was terminated. Collars and small eartags (3 x 5 cm) were replaced with large eartags (4.5 x 7.2 cm) in each ear. Each pair of eartags was permanently numbered with heat impressed numerals. Two different eartag colors were used to identify deer trapped on two major subunits within the study area. Deer captured on Kohler Mesa and south to Eldorado Springs were marked with yellow tags. Deer captured on Flagstaff Mountain and north to Lee Hill Road were marked with orange tags.

m_1 = # of marked animals in pop.

60

m_2 = # of animals censused while walking transect.

400

m_3 = # of marked animals in the census

30

Information on deer movements was obtained from observations of marked deer by personnel from Western Resource Development Corporation, Colorado Division of Wildlife personnel, City of Boulder park rangers, volunteers from the University of Colorado Environmental Center, retrap records, and observations by local residents. Areas with high potential for deer-vehicle collisions were determined from mapped locations of road-killed deer from the City of Boulder park rangers and Colorado Division of Wildlife deer roadkill data for Boulder County.

The deer population size was estimated using a mark-recapture method. A modified Peterson estimator originally proposed by Chapman (1951) was used for preliminary analysis of recapture data and estimation of population size. The population estimate

$$N = \frac{(n_1 + 1)(n_2 + 1)}{(m_2 + 1)} - 1$$

is denoted by N , n_1 is the number of deer caught, marked, and released, and n_2 is a sample of deer recaptured at a later time of which m_2 deer have been marked. Sixty-eight deer (n_1) were initially captured and marked. Approximately 6-7 weeks after the initial marking, four independent recapture samples (reobservations) on four successive days were taken. Each recapture sample was obtained by walking predetermined transect routes covering the entire study area and recording all marked and unmarked deer observed. All marked deer were recorded by eartag and neck collar number thus providing individual capture histories for each marked animal over the four samples. The same transect routes were walked each day providing uniform "trapping" effort for each sample.

The overall population estimate was calculated as an average of the four sample estimates. Confidence limits (90 percent) were constructed around the overall estimate using the variance about the four sample means.

$$SE(\hat{N}) = \sqrt{\frac{1}{K(K-1)} \sum_{i=1}^K (\hat{N}_i - \hat{N})^2}$$

RESULTS AND DISCUSSION

Trapping and Marking

From January through March 1983, 69 deer were trapped and marked (Appendix A). Fourteen deer were marked with colored neckbands and eartags, 49 were eartagged only, and 6 were marked with radiocollars. The sex and age composition of the marked animals was 33.3 percent bucks, 40.6 percent does, and 26.1 percent fawns (Table 1). This is equivalent to a buck:doe:fawn ratio of 82:100:64. Of the 69 deer marked, three were white-tailed deer. All three were captured on the south end of the study area.

Nearly equal numbers of males were captured on the north and south subunits of the study area. Adult bucks, though, were caught with greater frequency in the north end (Table 2). In the south subunit, a larger number of buck fawns were captured. Of the 36 female deer marked, 67 percent were adults. Within each of the age classes (fawns, yearlings, adults), the sample was nearly equally divided between the bucks and does. The distribution of marked deer among trap sites is given in Table 3. Locations of trap sites are shown on Figures 1 and 2. On the south end, the number of deer marked was nearly equally distributed between the three areas. In the north subunit, the most deer (13) were marked in the North Cedar Brook area on the ridgetop west of Wonderland Lake.

Deer Movements and Deer-Vehicle Collisions

An analysis of deer movements has not been completed. From only a cursory examination of the reobservation data for the marked animals, it appears that most of the deer exhibited strong fidelity to the general area where

TABLE 1

SEX AND AGE COMPOSITION OF MULE DEER
 CAPTURED AND TAGGED ON CITY OF BOULDER
 PARKS AND OPEN SPACE LAND
 JANUARY-MARCH 1983

<u>Sex</u>	<u>Age Class</u>			<u>Total</u>
	<u>Adult</u>	<u>Yearling*</u>	<u>Fawn</u>	
Male	18	5	10	32
Female	24	4	8	36
Total	42	9	18	69

*One female yearling killed by dogs January 25, 1983.

TABLE 2

MULE DEER AND WHITE-TAILED DEER TRAPPED AND MARKED,
 BY SEX AND AGE GROUP, WITHIN EACH SUBUNIT ON
 CITY OF BOULDER MOUNTAIN PARKS AND OPEN SPACE LAND,
 BOULDER COUNTY, COLORADO

<u>Sex</u>	<u>Age</u>	<u>Subunit</u>		<u>Total Marked</u>
		<u>South</u> ^a	<u>North</u> ^b	
Male	Fawn	7	3	10
	Yearling	4	1	5
	Adult	5	13	18
	Subtotal	16	17	33
Female	Fawn	5	3	8
	Yearling	4 ^c	0	4
	Adult	14	10	24
	Subtotal	23	13	36
	Total	39	30	69

^aSouth = Kohler Mesa to Eldorado Springs

^bNorth = Flagstaff Mountain to Lee Hill Road

^cOne female yearling killed by dogs on January 25, 1983

TABLE 3

DISTRIBUTION OF MULE AND WHITE-TAILED DEER CAPTURES
 BY SEX AND AGE GROUP FOR EACH TRAP SITE,
 CITY OF BOULDER MOUNTAIN PARKS AND OPEN SPACE LAND, BOULDER COUNTY, COLORADO

<u>Subunit Area</u>	Female			<u>Subtotal</u>	Male			<u>Subtotal</u>	<u>Total</u>
	<u>Fawn</u>	<u>Yearling</u>	<u>Adult</u>		<u>Fawn</u>	<u>Yearling</u>	<u>Adult</u>		
South									
Shanahan Ridge (traps 1A, 2, 5)	0	1	7	8	3	1	0	4	12
Fern/Bear Canyon (traps 3 and 4)	4	2*	3	9	2	2	0	4	13
Kohler Mesa (traps 6 and 7)	1	1	4	6	2	1	5	8	14
North									
Flagstaff Mountain (trap 10)	1	0	1	2	0	1	3	4	6
Sunshine Canyon (trap 11)	1	0	3	4	0	0	0	0	4
South Cedar Brook (trap 12)	0	0	1	1	0	0	4	4	5
North Cedar Brook (traps 13 and 15)	1	0	4	5	3	0	5	8	13
Lee Hill Road (trap 14)	0	0	1	1	0	0	1	1	2
Total	8	4	24	36	10	5	18	33	69

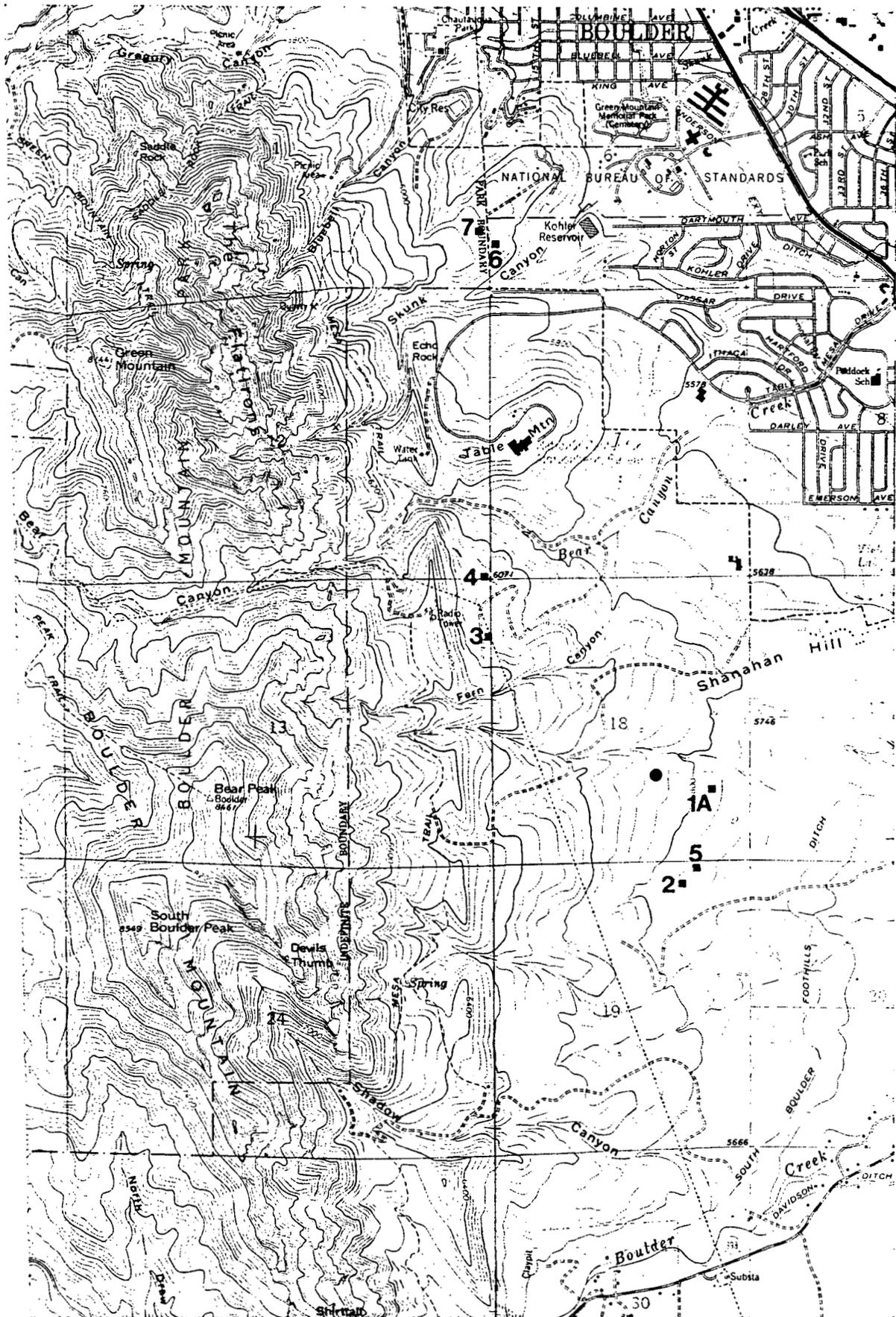


Figure 1. Locations of trap sites on south subunit.

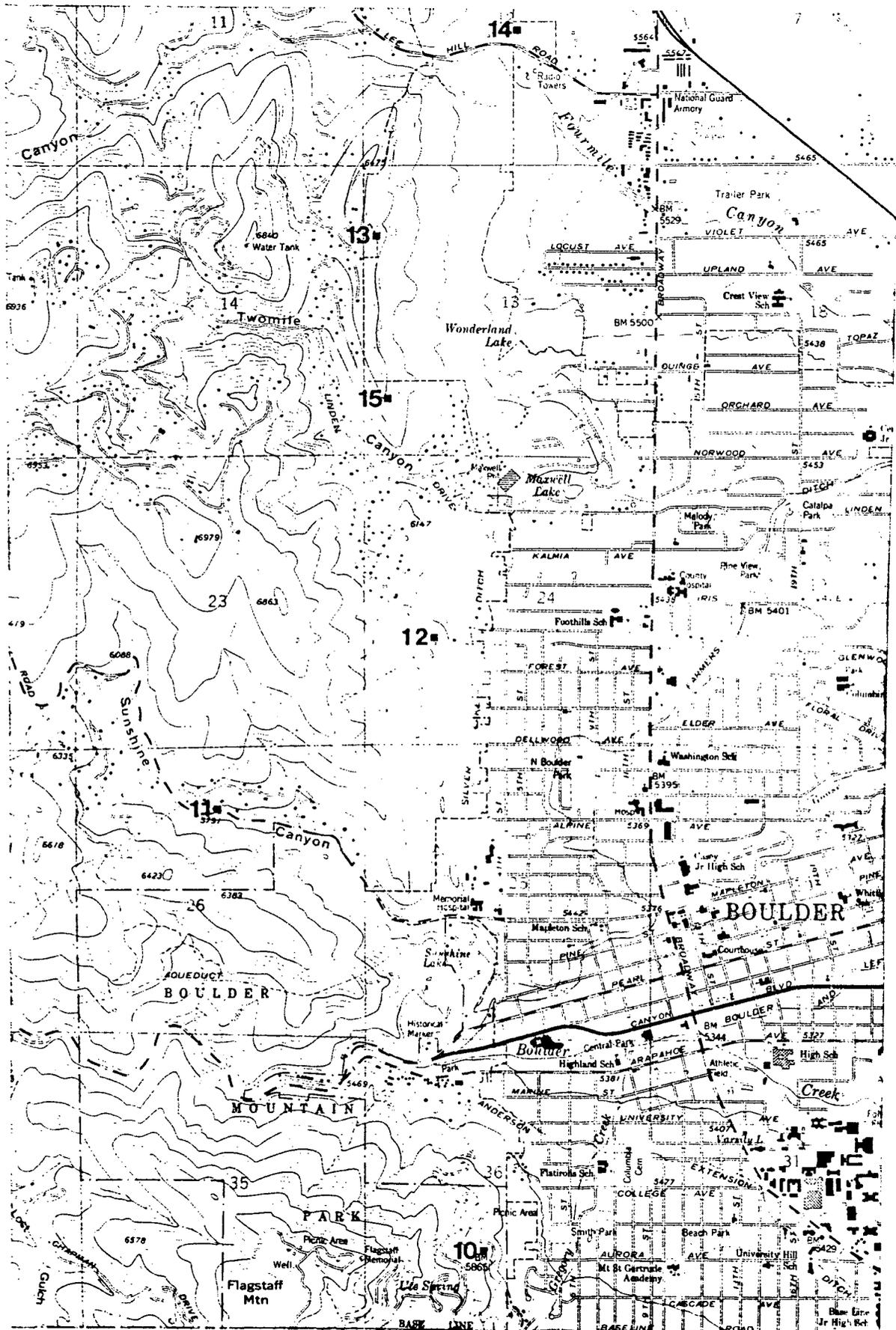


Figure 2. Locations of trap sites on north subunit.

they were trapped. Seventy-five percent of all deer marked were resighted at least once since they were captured.

From the examination of the deer road-kill data provided by the Colorado Division of Wildlife, seven geographic areas were defined:

- (1) Lee Hill and Old Stage Road;
- (2) Two Mile Canyon through the Pinebrook Hills subdivision;
- (3) Sunshine Canyon west of Boulder Memorial Hospital;
- (4) North Boulder, an area generally bounded by Linden Drive on the north, Broadway on the east, and Mapleton on the south;
- (5) Bureau of Standards along South Broadway and Baseline Road from Broadway to Flagstaff Mountain;
- (6) Table Mesa area immediately south of the Bureau of Standards and NCAR; and
- (7) Highway 398 along South Boulder Creek to Eldorado Springs.

These areas will be more extensively studied during the 1983-84 winter field season with respect to deer-vehicle accidents.

Population Estimates

For the area from Eldorado Springs north to Lee Hill Road, the deer population (with 90% confidence limits) was estimated at 782 \pm 52 deer. This estimate includes both mule and white-tailed deer because they occur sympatrically on the south end of the study area. White-tailed deer comprise only a very small percent of the total population.

The population estimate for the four independent samples ranged from 746 to 845 deer (Table 4). The total number of marked deer counted during the four samples ranged from 22 to 27 with an average of 25. The total number of animals counted in each sample ranged from 248 to 344.

TABLE 4
 RECAPTURE DATA AND POPULATION ESTIMATES
 FOR THE CITY OF BOULDER DEER HERD,
 18-21 APRIL 1983
 BOULDER COUNTY, COLORADO

<u>Sampling Date</u> April	<u>(n₂)</u> Total # Deer Counted	<u>(m₂)</u> Total # Marked Deer Counted	<u>(N)</u> Population Estimate
18th	342	27	844.25
19th	248	22	746.00
20th	293	25	779.23
21st	296	26	758.00
Average	294.75	25	782
Standard Error			44

The population estimate is only from a preliminary analysis of the recapture data. Additional analyses will be done to examine the validity of the underlying assumptions of the estimator. These assumptions are:

- (1) The population is closed to additions or deletions of animals during the period which the population size is being estimated;
- (2) Marks on animals (eartags and collars) are visible and are not lost;
- (3) All animals are equally likely to be caught in each sample.

1983-1984 Field Program

A major part of the 1983-84 field program will be devoted to describing and analyzing the deer-vehicle accident problem. Ten different variables have been identified that will be included in the final analysis (Allen and McCullough 1976, Carbaugh et al. 1975, Pils and Martin 1979, Puglisi et al. 1974, Reilly and Green 1974). These variables include time of day of accidents, traffic volume, traffic speed, amount of deer activity near roads, roadside vegetation, road configuration, type of road, month of year, and the amount of increased residential development in surrounding areas for the past 5-10 years.

Additional deer will be captured and marked during November and/or December 1983. The objective will be to supplement the number of marked deer, particularly in areas where the number marked the first winter was low. The trapping program is expected to be only 2-3 weeks at the most. An additional five adult does will also be radiocollared. Monitoring of previously marked deer will continue throughout the remainder of the study.

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APPENDIX A

DEER TAGGED AND MARKED

TABLE A-1

MULE DEER TAGGED AND MARKED IN THE SOUTH SUBUNIT
OF THE CITY OF BOULDER MOUNTAIN PARKS AND OPEN SPACE LAND, 1983

Date Tagged	Sex	Age	Eartag (yellow)		Neck Collar Color/Number	Remarks
			Left	Right		
1/ 4/83	F	Ad	-	-	Y1	
1/ 4/83	F	Yr	-	Y2	-	killed by dog 1/25/83
1/ 4/83	F	Fn	-	Ye	-	
1/ 4/83	F	Ad	-	Y4	Yr	
1/ 5/83	F	Ad	-	Y5	Y5	
1/ 5/83	F	Yr	-	Y6	Y6	
1/ 5/83	F	Yr	-	Y7	-	white radiocollar - 148.110
1/ 6/83	F	Ad	-	-	Y8	white-tail
1/12/83	M	Yr	-	Y14	Y14	white-tail
1/12/83	F	Ad	-	Y10	Y10	
1/13/83	M	Ad	-	Y11	-	
1/13/83	M	Ad	-	Y12	-	
1/13/83	M	Fn	-	Y13	-	
1/13/83	M	Ad	-	Y19	-	
1/14/83	F	Ad	-	Y20	-	scar behind left leg
1/14/83	F	Ad	-	Y15	Y15	
1/15/83	M	Fn	-	Y16	-	
1/15/83	M	Fn	-	Y17	-	
1/16/83	F	Ad	-	Y18	Y18	
1/19/83	M	Fn	-	Y22	-	
1/20/83	F	Ad	Y21	Y21	Y21	
1/22/83	F	Ad	-	Y9	Y9	
1/22/83	F	Fn	Y23	Y23	-	
1/24/83	F	Ad	Y24	Y24	Y24	white-tail
1/24/83	M	Yr	-	Y25	Y25	
1/24/83	F	Ad	Y26	Y26	Y26	
1/19/83	F	Fn	Y27	Y27	-	
1/21/83	F	Fn	-	Y28	-	
1/25/83	M	Fn	Y29	Y29	-	
1/26/83	F	Fn	Y30	Y30	-	
1/27/83	M	Fn	Y31	Y31	-	
1/27/83	F	Yr	Y32	Y32	-	
1/28/83	F	Ad	Y33	Y33	-	
1/29/83	M	Yr	Y34	Y34	-	
1/29/83	M	Fn	Y35	Y35	-	
2/15/83	F	Ad	-	-	Y	148.290
2/19/83	M	Yr1	Y36	Y36	-	
2/23/83	M	Ad	Y37	Y37	-	
2/27/83	M	Ad	Y38	Y38	-	