STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF FISH AND GAME

PRONGHORN ANTELOPE MANAGEMENT PLAN

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UNDER THE SUPERVISION
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PRONGHORN ANTELOPE MANAGEMENT PLAN

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ABSTRACT

Objectives and management strategies for California's pronghorn population are in need of revision. A rapid population increase has resulted in increased depredation problems and lowered productivity. The pronghorn range in California is divided into six herds in northeastern California plus a population in Mono County, each will be managed under its own set of goals and objectives.

INTRODUCTION

Northeastern California contains over ninety-five percent of the free roaming pronghorn antelope in the state and as a result most of the following information pertains to the population in Northern California. Historically, pronghorn were probably the most numerous big game animals in the state, inhabiting all but the higher mountain ranges and the north coastal area (Figure 1). By 1940, pronghorn had been extirpated from all but northeastern California, this dramatic decline beginning with the gold rush in 1849 and market hunting. Agriculture and urban development following the gold rush reduced the pronghorn population from an estimated 500,000 to about 1,000 animals by 1923. Pyshora (1977) provides a summary of the historical status of pronghorn and Anderson (1960) summarizes the status and relocation efforts for the Mono County population.

Since 1923, the population has increased to about 7,000 animals in northeastern California (Figure 2, Table 1) plus about 100 animals in Mono County.

The Department of Fish and Game has been managing these populations without benefit of a formal policy or management plan. The population increase and concurrent expansion of agriculture have resulted in increasing crop depredation and lowered herd production, pointing out the need for changes in management

FIGURE 1

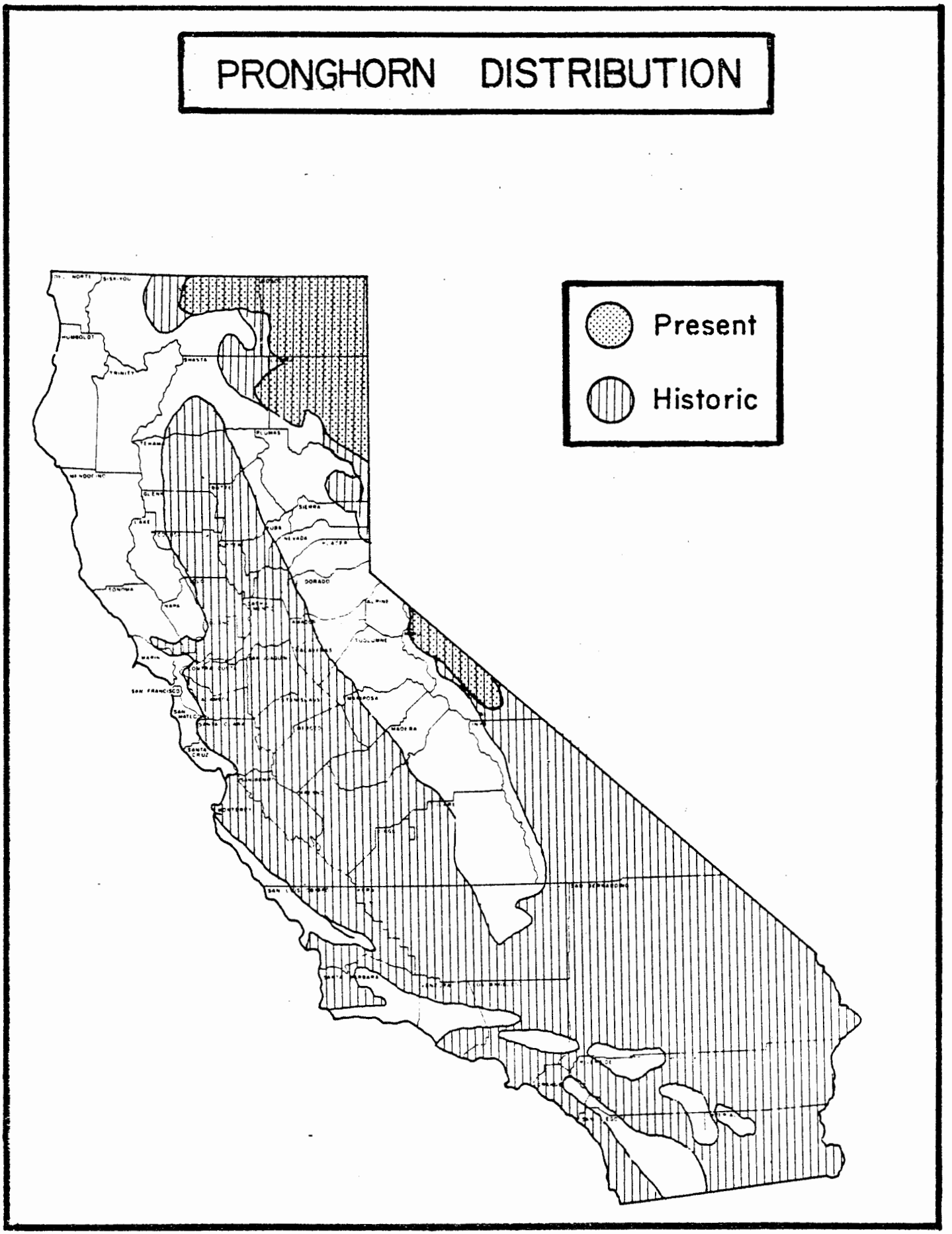
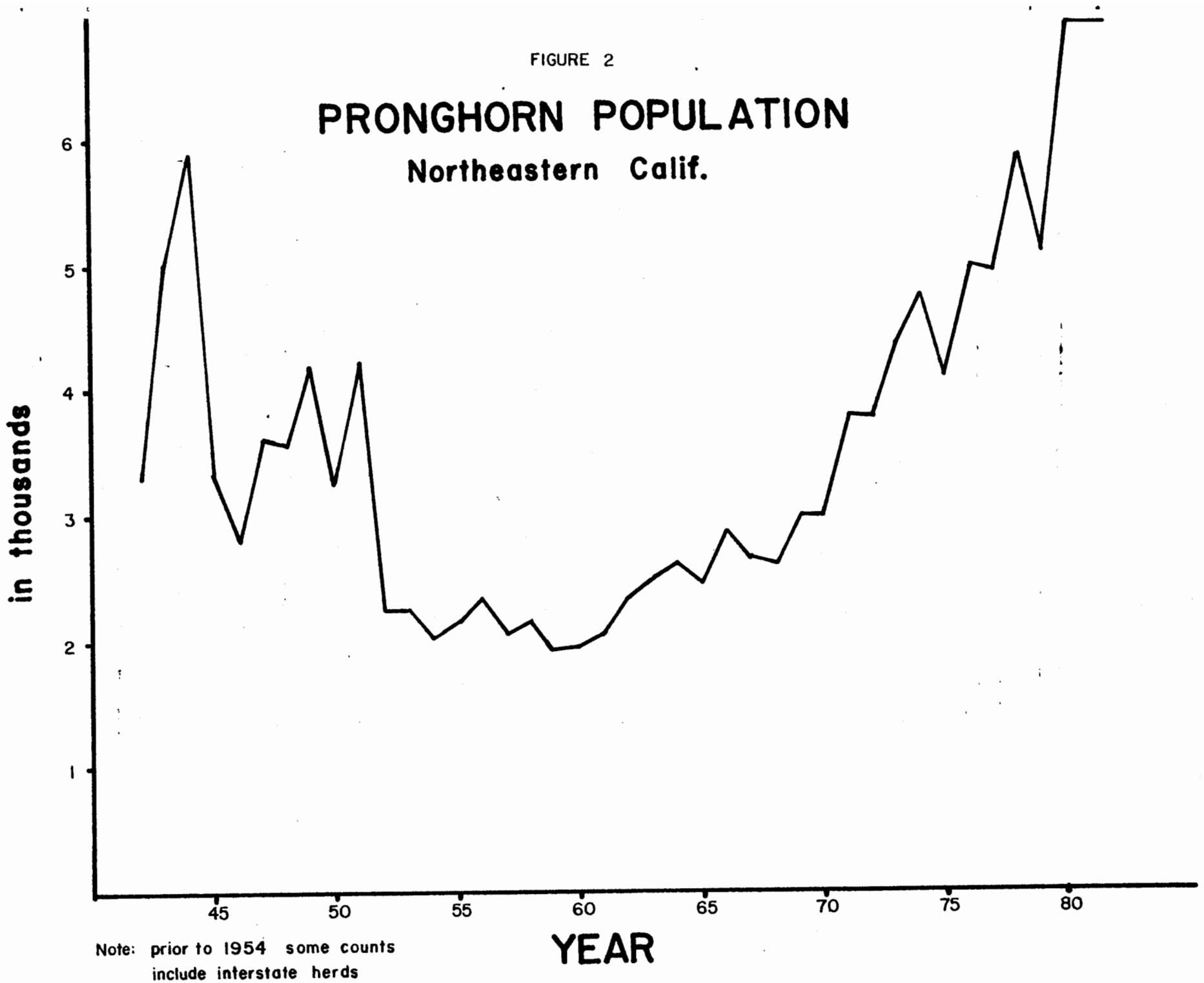


FIGURE 2



Note: prior to 1954 some counts include interstate herds

TABLE 1 - Winter Pronghorn Census By County - Northeastern California

YEAR	LASSEN	MODOC	SHASTA	SISKIYOU	PLUMAS	TOTAL
1942	3,059	656	--	37	36	3,788
1943	3,962	1,103	--	273	--	5,338
1944	4,504	1,167	171	305	--	6,147
1945	4,142	597	--	--	--	4,739
1946	1,800	929	--	69	--	2,798
1947	3,113	836	--	--	--	3,949
1948	2,209	1,280	--	103	--	3,592
1949	3,042	1,690	--	--	--	4,732
1950	2,260	976	--	--	--	3,236
1951	1,901	2,635	--	--	--	4,536
1952	848	1,434	0	-	--	2,282
1953	811	1,167	22	125	--	2,125
1954	573	1,097	30	150	--	1,850
1955	573	1,142	31	217	--	1,975
1956	744	1,397	0	197	--	2,338
1957	708	1,042	26	197	--	1,973
1958	576	1,353	21	215	--	2,165
1959	589	1,124	24	180	--	1,917
1960	568	1,068	16	128	--	1,780
1961	501	1,280	18	110	--	1,909
1962	600	1,620	13	36	--	2,269
1963	694	1,531	18	132	--	2,375
1964	746	1,672	23	177	--	2,618
1965	834	1,454	121	59	--	2,468
1966	1,017	1,479	30	209	--	2,735
1967	1,040	1,251	23	223	--	2,537
1968	884	1,469	0	254	--	2,607
1969	1,031	1,595	0	244	--	2,870
1970	1,031	1,800	37	115	--	2,983
1971	1,412	2,147	2	239	--	3,800
1972	1,383	2,109	0	272	--	3,764
1973	1,262	2,734	0	361	--	4,357
1974	1,615	2,767	0	365	--	4,747
1975	1,252	2,506	22	329	--	4,109
1976	1,491	2,943	0	435	--	4,869
1977	1,420	2,818	43	627	--	4,908
1978	1,974	3,245	1	652	--	5,872
1979	1,590	2,894	0	614	--	5,098
1980	2,094	3,944	0	872	--	6,910
1981	2,020	3,823	68	994	--	6,905

-- Indicates either no census was made in these areas or no pronghorn were found there. No recent census attempts have been made in Plumas County since pronghorn are no longer in the area.

strategies. This plan includes individual objectives and strategies for each herd designed to insure that they are productive.

RANGE AND HISTORY

The northeastern California pronghorn population occupies most of the northeast geological sub-region of the state. The pronghorn range includes the area east of the Cascade and Sierra-Nevada Mountain ranges from Lassen County north. It is composed basically of lava and is relatively flat except for the Warner Mountains and a few isolated mountain ranges.

Soils

Quaternary and tertiary volcanic rocks predominate in this area. There are areas of precambrian to recent rock complex in southern Lassen County and in the Warner Mountains and Surprise Valley area of Modoc County. A small area of mesozoic-paleozoic metamorphic and granite rocks occurs in southernmost Lassen County.

Major soil categories include Valley Basin soils which are slightly weathered, heavy textured alluvial or lake deposits, terrace soils composed of extensively weathered alluvium or lake deposits, and upland soils composed of lightly or moderately weathered soils with underlying or exposed bedrock.

Climate

Climate is typical of the Great Basin Province with low precipitation, cold winters, and warm dry summers. Average yearly precipitation ranges from 20.3 to 50.8 cm (8 to 20 inches) depending on the specific area. July temperatures range from about 16 to 21 degrees°C (60-70°F), and January temperatures range from about -7 to -1 degrees°C (20-30°F). Frost-free summer periods range from 80 to 120 days.

Vegetative Communities

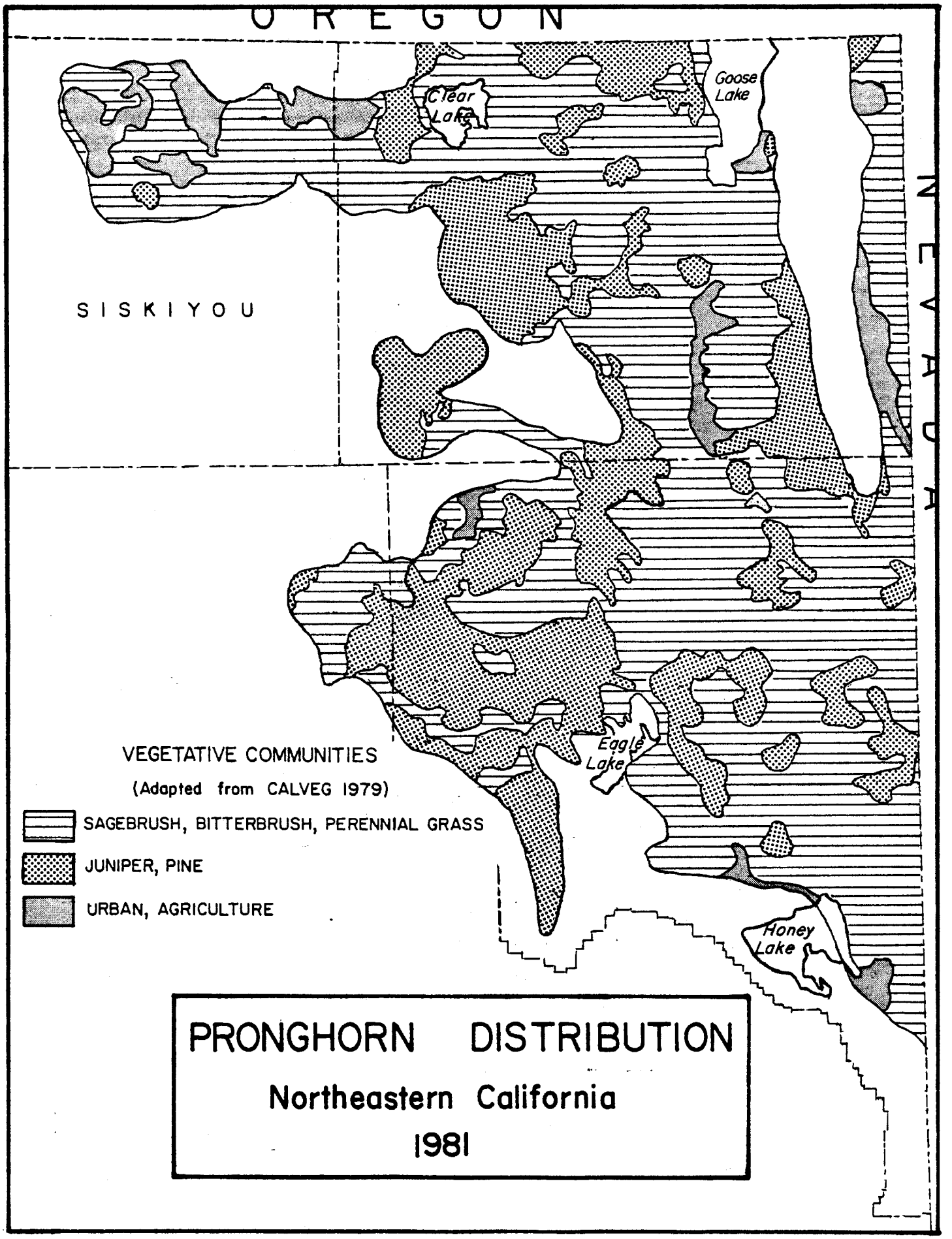
Vegetation represents a transition between Great Basin types and those of the mountains to the west. The largest area in California of great basin sagebrush, found in association with bunch grass, annual grass, bitterbrush, and saltbush occurs here. The east side Sierra forest, primarily pines and firs, covers much of the western half of the area and also occurs in the Warner Mountains (Figure 3).

Vegetation distribution is influenced by terrain, altitude, soils, and water. Young unweathered lava flows typically have very little cover. Riparian vegetation occurs along stream courses and seasonally wet meadows are fairly common. Riparian and meadow vegetation is heavily used by livestock.

Winter pronghorn range is primarily low sage habitat. Black sage and big sage are predominant sages occurring on winter ranges. Big sage occurs in deeper soil areas. Bitterbrush also occurs, but in very limited amounts. Rabbitbrush, saltbush, tumbling mustard, and cheatgrass commonly occur. Squirreltail, bluebunch wheatgrass, and fescue are some of the perennial grasses which occur, though these grasses are not a major ground cover on the winter range. Appendix 1 is a partial list of the plants of the area.

There is considerable variation in summer range habitats. Pronghorn summering in the Gray's Valley-Pine Creek Valley-Harvey Valley area range on a dry meadow habitat. Perennial grasses, a dry land carex, annual forbs, and sage are predominant vegetation on this summer range. Other summer ranges include juniper/sage, sage/grassland, cultivated crops, i.e., alfalfa, wet meadows, large vernal ponds, and grass/forb habitats. More specific habitat types are discussed in the individual herd plans.

FIGURE 3


OREGON
Clear Lake
Goose Lake
SISKIYOU
NEVADA
Eagle Lake
Honey Lake
VEGETATIVE COMMUNITIES
(Adapted from CALVEG 1979)
SAGEBRUSH, BITTERBRUSH, PERENNIAL GRASS
JUNIPER, PINE
URBAN, AGRICULTURE
PRONGHORN DISTRIBUTION
Northeastern California
1981

Water Sources

Because of the dry summer climate and porous rocky soils, surface water is not common in some areas. The few streams are tapped for irrigation and stock tanks have been constructed to provide seasonal water for livestock and wildlife. Widely spaced springs occur in some portions of the range providing natural water and green forage. Except for limited areas, sufficient water is available for pronghorn.

Land Ownership and Use

Pronghorn inhabit about 1,437,000 hectares (3,552,000 acres) of California. About two thirds of this area is public land administered by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) (Table 2).

Cattle ranching is the leading commercial use, followed by lumbering operations, recreation, and crop irrigation. Most of the pronghorn population uses the federal rangelands for subsistance. There is an increase in pronghorn use of alfalfa on private land as the pronghorn population increases and the acreage of this habitat is expanded into pronghorn range.

Seasonal Ranges

Most pronghorn in California are migratory. Animals travel up to 112.7 kilometres (70 miles) semiannually from summer to winter ranges and back. Fall migrations are sometimes abrupt depending on weather conditions, and are usually triggered by the first significant snowfall. During mild winters of light snowfall, pronghorn may remain on summer or transitional ranges through the winter. Spring migrations to summer range are usually a gradual drift of animals.

Migration corridors from summer to winter range are specific paths used year after year. Pronghorn do not normally deviate from these paths, making them

TABLE 2

LAND OWNERSHIP OF PRONGHORN RANGE

HERD	FOREST SERVICE		B.L.M.		PRIVATE		MISC.		TOTAL	
	HA	ACRES	HA	ACRES	HA	ACRES	HA	ACRES	HA	ACRES
Mount Dome	23,068	57,000	14,569	36,000	50,182	124,000	14,974[1/]	37,000	103,198	255,000
							405[2/]	1,000		
Clear Lake	153,072	378,240	2,331	5,760	26,418	65,280	12,691[1/]	31,360	194,512	480,640
Likely Tables	176,042	435,000	58,681	145,000	96,317	238,000	2,833[1/]	7,000	333,873	825,000
Lassen	32,635	80,640	277,394	685,440	175,605	433,920	0	0	485,634	1,200,000
Big Valley	18,211	45,000	24,282	60,000	82,962	205,000	0	0	125,455	310,000
Surprise Valley	405	1,000	39,458	97,500	6,677	16,500	0	0	46,540	115,000
Mono	66,653	164,700	51,841	128,100	29,624	73,200	0	0	148,118	366,000
	470,086	1,161,580	468,556	1,157,800	467,785	1,155,900	30,903	76,360	1,437,330	3,551,640

1/ Fish and Wildlife Service

2/ National Park Service

a crucial segment of the overall range. Loss of a corridor due to fencing, housing, or other development could result in a significant loss of pronghorn.

Fire History

From the time of settlement by Europeans in the early 1900's, both wildfires and fires set to manipulate vegetation were allowed to burn unless they threatened population centers. From that time to the present, fire control has gradually improved, resulting in fewer areas burned. Except for occasional years when fire conditions have become extreme, such as during 1977 when well over 100,000 acres burned in northeastern California, wildfires have not had a major impact on pronghorn habitat. Railroad engines occasionally start fires, mainly where annual grasses border the railroad. Fire, probably as early as the late 1800's, played an important part in the conversion of perennial grass ranges to brush, juniper and annual herbacious vegetation.

Livestock Grazing History

By 1870, livestock breeding stocks had been established throughout eastern Oregon. However, the Indian hostilities prevented grazing in some of the planning area until cessation of the Modoc War in 1873. "As soon as the war ended, human settlements erupted and the short-lived era of range destruction by cattle was on." (Oliphant 1968). By 1875, sheep and cattle were considered to be "over-stocked" on many ranges (Oliphant 1968).

Earliest livestock grazing was year-round with no supplemental feed provided. Livestock were allowed to graze what was considered to be unlimited perennial grass ranges, without benefit of any management systems. As a result, sheep, horses, and cattle numbers increased to the point where heavy overgrazing occurred. The combination of heavy grazing, fires set to control vegetation, and wildfires resulted in the loss of most perennial grass and forb ranges.

Perennial grasses and forbs were replaced by shrubs, annual grasses, annual forbs, and juniper. Juniper, which rapidly invaded following the beginning of fire control, reduces the open aspect required by pronghorn for escape behavior. Prior to the advent of domestic grazing animals, sagebrush mixed with perennial grasslands provided good habitat for bighorn sheep. Pronghorn were also present, but little information is available on abundance. A series of severe winters with heavy snow in the late 1800's, coupled with a lack of forage, resulted in heavy livestock losses. The winter of 1890-91 was extremely hard on livestock with some ranchers losing most of their cattle. Pronghorn presumably suffered significant losses as well.

Livestock operators realized that grass supplies were indeed limited and called for grazing controls. The Modoc Forest Preserve was created in 1904 and was consolidated into the Modoc National Forest in 1908. The Lassen, Modoc, and Klamath National Forests had all been established in the planning area by 1910. Forest managers immediately banned transient sheep and began regulating the number of grazing animals and seasons of use. Since the inception of the USFS and later the BLM, grazing has been regulated on public domain. Controls have gradually become more and more complete leading to the present strictly regulated grazing use.

Logging and Reforestation

Logging and reforestation have little effect on pronghorn. In the past, clear-cut and burn logging around the periphery of timber stands have provided some temporary habitat, but this type of logging is now very limited. Reforestation of wildfire burns accelerates the decline of forbs, which reduces pronghorn forage.

Hunting Program

Legislation was enacted in 1942 to permit the harvest of pronghorn. The first special bucks-only hunt with a limited number of permits was held in 1942 (Table 3). Such hunts were held intermittently until 1964. Since 1964, special hunts have been held each year.

Habitat Conversion and Land Use

Habitat conversions that have an impact on pronghorn are primarily agricultural. Herbicide treatment of sage to release either native or seeded perennial grasses has affected both winter and summer ranges. Irrigation to develop pasture and/or hay crops is the most common type of habitat conversion in Northern California. Landowners are continuing to extend irrigated crops, primarily alfalfa, into pronghorn range.

Loss of native habitat, rising pronghorn numbers, and introduction of alfalfa have caused pronghorn to increasingly use this exotic forb as forage. This results in more depredation problems each year.

Dry land grain farming is also increasing at the expense of juniper, sagebrush and perennial grasslands. Opening up juniper stands would benefit pronghorn, but the grain crops, which in many cases replace the juniper, are poor pronghorn forage.

The development of recreational subdivisions and suburbs has had limited impact to date, but the potential exists for serious problems of this kind.

Population Dynamics

As indicated above, pronghorn were probably the most numerous big game mammals in California until shortly after the gold rush, when the demand for meat caused high harvest, and land use changes drastically reduced suitable habitat, resulting in a rapid decline in their numbers. By 1923, only 1,057 pronghorns

TABLE 3

PRONGHORN HARVEST BY HERD
Northeastern California

Year	Permits Issued	Mount Dome	Clear Lake	Likely Tables	Lassen	Big Valley	Surprise Valley	Total
1942	500							405
1943	500							362
1944	500		Hunts prior to 1966 were operated					322
1945	500		under various hunt zone systems					307
1949	500		so data are not comparable with					349
1951	416		1966-1980 data.					280
1959	171							120
1964	240							183
1965	240							141
1966	265	25	18	*51	57	17	11	179
1967	250	21	12	45	70	0	11	156
1968	260	23	18	61	73	4	10	189
1969	270	21	21	73	74	12	0	204
1970	300	17	35	58	89	29	13	241
1971	400	11	47	87	118	24	15	303
1972	380	25	52	90	98	23	13	301
1973	385	40	66	94	72	22	11	305
1974	410	23	58	89	95	14	5	284
1975	225	16	30	75	32	13	4	170
1976	375	29	51	124	71	19	12	306
1977	325	48	43	80	77	7	16	271
1978	400	54	37	116	127	13	5	352
1979	374	56	36	146	50	26	15	329
1980	*489	68	47	143	84	32+15 does	1(archery only)	390

*Includes 25 archery and 20 doe permits.

could be found in six widely separated areas of the state. By 1940, pronghorn bands in Southern California had disappeared and only the northeastern California population remained.

In 1942, 3,788 animals were counted in the first aerial census of pronghorn in California (Stokes, 1947). From the 1942 level, the population increased to over 6,000 animals and then declined to the most recent low of 1,780 in 1960. Since 1960, the population has steadily increased to the 1980 and 1981 totals of over 6,900 animals (Table 4).

Aerial herd composition surveys of buck and kid ratios per 100 does were begun in 1953 (Figure 4, Tables 5 and 6). These data indicate declining trends in buck and kid ratios per 100 does since the late 1960s.

In addition, most individual herds show long-term downward trends in buck and kid ratios (Tables 4, 5 and 6).

MAJOR FACTORS REGULATING THE POPULATION

Food Habits on Seasonal Ranges

Based on studies in California and other western states, forbs and browse constitute most of the pronghorn's diet. Forbs are important summer forage and browse, primarily sagebrush species, are the dominant winter forage. Grass, predominantly cheatgrass, is used at a low level.

Appendix 2 shows food habits based on analysis of 168 rumen samples of Oregon pronghorn (Yoakum 1958). Over sixty species of forbs were identified in stomach samples of California pronghorn (Ferrel and Leach 1950). Alfalfa is increasingly being utilized by pronghorn as additional acreage of this forb is available to them. Bitterbrush is the only browse, other than sage species, that receives appreciable use by pronghorn.

TABLE 4. Winter Pronghorn Census by Herd - Northeastern California

Year	Total*	Mount Dome Herd	Big Valley Herd	Clear Lake Herd	Likely Tables Herd	Lassen Herd	Surprise Valley*	Misc.
1956	2,338	197	261	506	624	524	-	226
1957	1,973	197	286	392	508	590	107	-
1958	2,165	215	328	408	751	438	-	25
1959	1,917	180	299	357	605	464	-	12
1960	1,780	128	288	316	554	445	181	49
1961	1,909	110	279	378	696	424	162	22
1962	2,269	36	349	748	700	435	85	1
1963	2,375	132	387	685	709	424	123	38
1964	2,618	177	367	520	953	524	-	77
1965	2,468	59	358	518	734	757	-	42
1966	2,735	209	289	600	751	886	163	-
1967	2,537	223	281	544	563	881	128	45
1968	2,607	254	177	675	693	807	-	1
1969	2,870	244	292	619	861	854	101	-
1970	2,983	115	389	840	819	820	16	-
1971	3,800	239	327	894	1,145	1,195	-	-
1972	3,764	272	314	803	1,251	1,124	-	-
1973	4,357	361	411	1,386	1,196	1,003	-	-
1974	4,747	365	656	1,362	1,236	1,126	-	2
1975	4,109	329	364	1,020	1,312	1,069	-	15
1976	4,869	435	758	1,236	1,526	913	118	1
1977	4,908	625	423	1,195	1,371	1,285	-	7
1978	5,872	652	606	1,493	1,478	1,643	-	-
1979	5,098	614	592	1,047	1,487	1,358		
1980	6,910	872	1,291	1,350	2,206	1,191		-
1981	6,905	994	1,029	1,176	2,250	1,428		28

* Erratic occurrences of Nevada pronghorn in Surprise Valley are not included in the total.

FIGURE 4

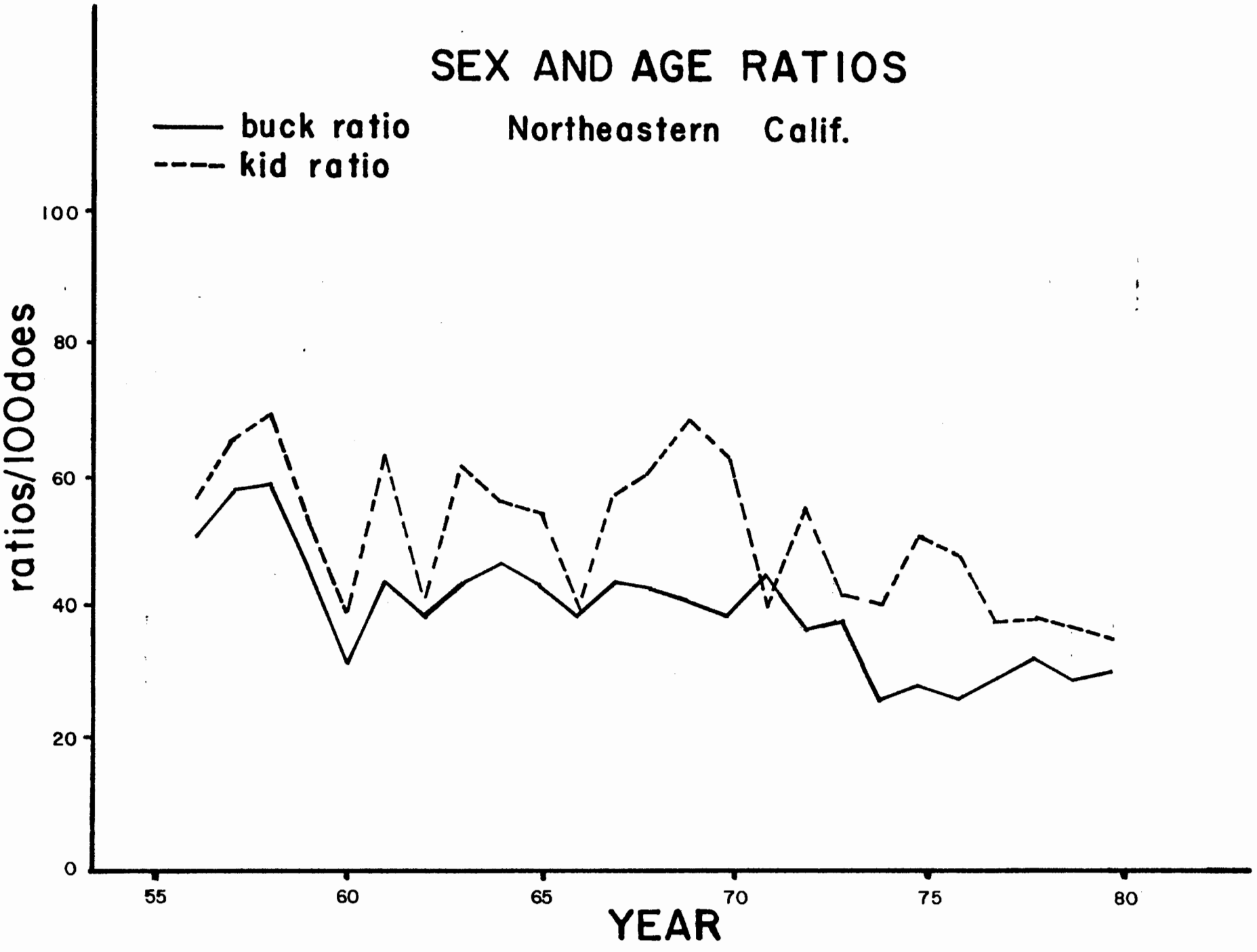

SEX AND AGE RATIOS
buck ratio
kid ratio
Northeastern Calif.
ratios/100does
100
80
60
40
20
0
55
60
65
70
75
80
YEAR

Table 5. Mid-Summer kid-to-doe (KK:100DD) ratios by Herd - Northeastern California.

Year	All Herds	Mount Dome Herd	Big Valley Herd	Clear Lake Herd	Likely Tables Herd	Lassen Herd	Surprise Valley Herd
1956	57	61	49	88	68	55	38
1957	66	43	66	63	80	62	63
1958	70	41	66	62	80	75	77
1959	53	57	66	70	53	44	70
1960	39	35	41	40	35	41	61
1961	64	-	66	74	55	66	65
1962	42	94	43	42	39	51	53
1963	62	70	46	84	57	58	73
1964	57	95	57	83	37	53	85
1965	53	70	45	65	45	49	52
1966	40	52	44	42	38	36	34
1967	58	78	44	92	60	48	56
1968	61	62	67	96	46	71	60
1969	69	55	49	100	57	73	73
1970	63	66	29	73	62	70	62
1971	40	50	39	68	34	28	53
1972	55	85	63	80	44	45	65
1973	42	40	72	69	52	25	60
1974	41	55	57	61	39	33	39
1975	51	86	49	66	46	46	96
1976	48	71	57	73	51	35	71
1977	38	60	44	75	29	35	49
1978	38	51	64	41	32	34	52
1979	37	36	44	35	44	32	38
1980	35	74	54	30	42	26	27
1981	40	84	47	46	40	30	11

TABLE 6

BUCKS/100 DOES BY HERD

Year	Mount Dome	Clear Lake	Likely Tables	Big Valley	Surprise Valley	Lassen	N.E. Calif.
1956	52	107	67	14	39	37	51
1957	63	71	72	94	33	28	58
1958	70	91	71	34	51	33	59
1959	94	45	52	47	52	32	46
1960	35	27	33	28	59	27	32
1961	No Data	64	55	44	37	29	44
1962	34	36	40	33	38	45	39
1963	75	50	56	36	38	36	44
1964	77	58	44	65	41	41	47
1965	71	38	38	62	33	46	44
1966	53	33	28	34	31	45	35
1967	49	16	46	31	25	46	40
1968	43	40	42	48	32	34	39
1969	50	24	36	60	16	46	37
1970	23	28	31	39	42	30	35
1971	28	38	48	39	41	41	41
1972	42	41	31	21	27	31	33
1973	35	41	37	19	22	32	34
1974	23	35	26	30	18	27	26
1975	18	27	30	19	56	25	28
1976	45	31	23	9	35	25	26
1977	45	26	31	8	20	32	29
1978	49	31	43	18	29	27	32
1979	39	38	30	20	30	25	29
1980	45	54	31	12	33	25	30
1981	59	35	42	19	67	21	31

Wildfires

Pronghorn feed heavily on burned areas in spring and summer ranges as soon as forbs emerge. Pronghorn move from their normal ranges to adjacent burn areas to take advantage of the emerging vegetation.

Wildfire on winter range areas, on the other hand, can have adverse effects. If a fire burns sage on winter range, it can result in a loss of animals due to a loss of this key winter forage. Cheatgrass and rabbitbrush, not a preferred winter diet, usually emerge initially after a fire on winter ranges. Being non-sprouters, sages often take several years to reestablish.

Livestock Grazing

Buechner (1947) reported the results of a study of pronghorn/livestock forage use relationship in Texas. He indicated that "antelope prosper well on cattle ranches, even on overgrazed ranges, since cattle are grass consumers and leave most of the forbs and browse for antelope." He found, however, that pronghorn/sheep competition can be much more severe. Since sheep and pronghorn diets are more similar, there is more direct competition. The starvation of pronghorn on overgrazed sheep pastures was consequently reported.

Wild horses and burros are common on some parts of the pronghorn range. These species use considerable forage themselves, and it is likely that their grazing pressure forces other grazing species to compete for pronghorn forage.

Rural Development and Land Use

There are two significant impacts of this activity. Recreational subdivisions and agricultural expansion into previously unfarmed ranges are reducing and/or changing pronghorn range (Figure 3). Subdivisions permanently displace pronghorn. Agricultural expansion, particularly of alfalfa, can provide more seasonal forage, but may reduce the winter range areas. Use of alfalfa by

pronghorn leads to depredation incidents, which are increasing in number and intensity as pronghorn numbers and alfalfa acreage increase.

Influences of Weather

Weather affects pronghorn primarily in two ways. It influences seasonal migrations and affects annual forage conditions. Pronghorn migrations from summer to winter ranges are often very rapid movements influenced by snow. A fall snowstorm may cause rapid movements of 80 or more kilometres (50 or more miles) as pronghorn attempt to reach winter range. Spring migrations to summer ranges are more gradual.

Precipitation affects the quantity and quality of vegetation, primarily of annual forbs and grasses.

Mortalities can occur if snow becomes deep enough to impede pronghorn movement and/or feeding.

Mortality Factors

Recent studies in Nevada indicate that up to fifty percent of the kids born may be taken by predators, primarily coyotes (March and McNay, 1980). Other mortality factors include accidents, hunting (both legal and illegal), and forage deficiencies. Although it appears that predation of kids is very high, it is not felt to be a primary limiting factor. By contrast, forage does appear to be the limiting factor on production.

Deep snows have resulted in starvation of pronghorns. A loss of about 50% of the northeastern California population occurred during the winter of 1951-52 when deep snow prevented pronghorn from foraging. The most severe loss occurred in the eastern part of the Lassen Herd where an entire winter population of about 1,000 animals was extirpated.

Pronghorn can endure extreme cold due to the insulating quality of their hair, but deep snow can be devastating.

MANAGEMENT PROBLEMS AND SOLUTIONS

Several publications and reports, Pyshora, 1977 and 1978, and Salwasser and Shimamoto, 1979, point out the need to develop strategies for management of the northeastern California pronghorn. This population has rapidly increased to the point where annual production is declining and crop depredation is severe.

The California population consists of five fairly separate resident herds plus two interstate herds, one in Surprise Valley, Modoc County and one in the Bodie Hills area, Mono County (Figure 5). Separate management strategies are necessary for each of these herds.

MANAGEMENT UNIT GOALS OBJECTIVES, AND STRATEGIES

Management objectives by herd, including population goals, are proposed. A draft pronghorn policy is also proposed for Fish and Game Commission consideration (Appendix 3).

In order to select population goals and management strategies most efficiently, computer simulation models have been developed for each northeastern herd (Appendix 4).

These simulation models are a modification of Program ONEPOP, (Gross et al. 1973). By programming the model with known census and herd ratio data, estimates of mortality and natality data, trends can be projected. The models simulate the effects of different management strategies on the population. Because the input data are reliable, the models offer an economical method of analyzing data and management options.

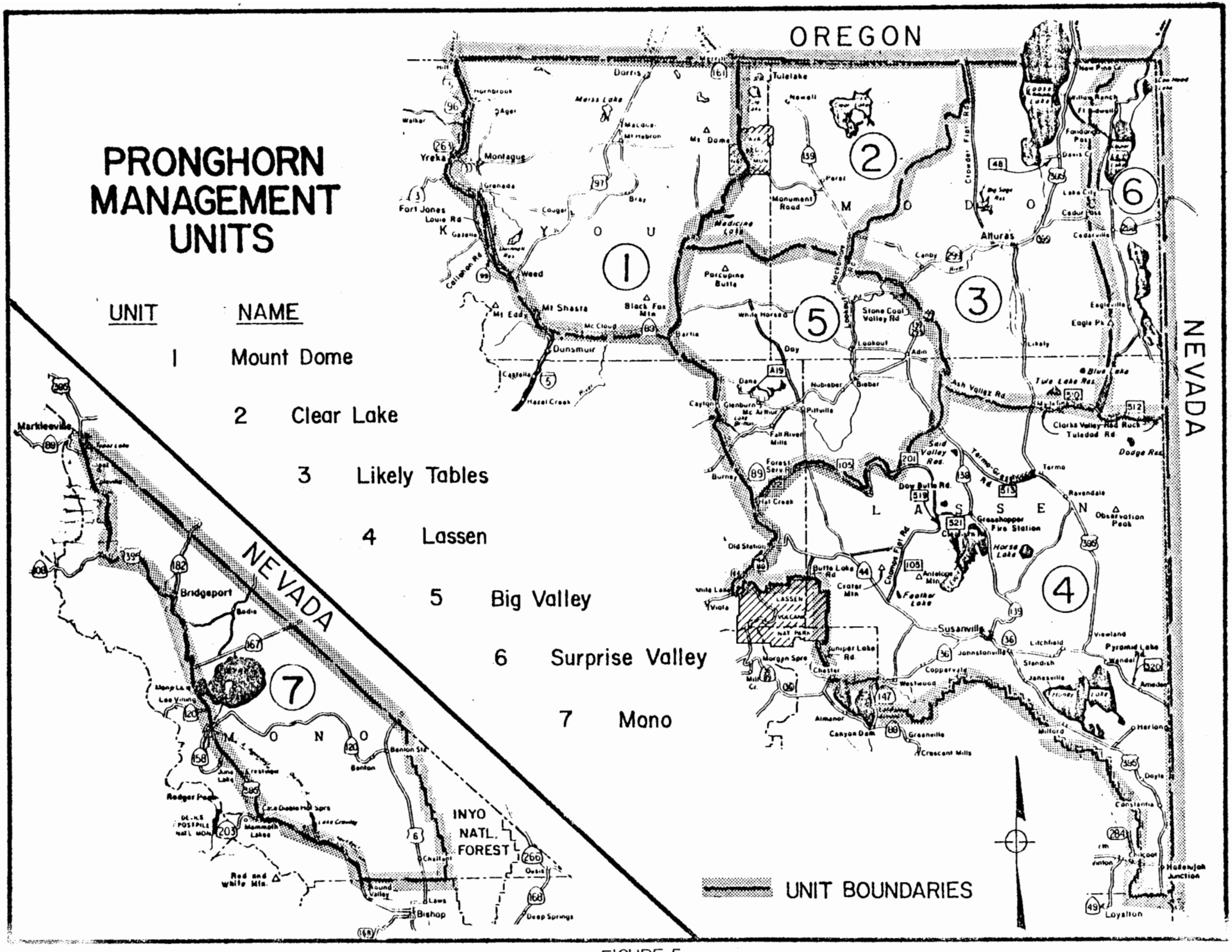

PRONGHORN MANAGEMENT UNITS
UNIT NAME
1 Mount Dome
2 Clear Lake
3 Likely Tables
4 Lassen
5 Big Valley
6 Surprise Valley
7 Mono
OREGON
NEVADA
NEVADA
UNIT BOUNDARIES
INYO NATL. FOREST

FIGURE 5

The objective is to manage each herd at the maximum number that the area can support in a healthy, productive state. Herd size objectives were determined by considering present reproduction, herd ratios, depredation problems, trend in range uses, and condition of and demands for this resource. Population models were used to test management strategies and determine population goals for the five resident herds. Hunting strategies will be altered to fit the herd boundaries and harvest of animals will be designed to meet specific herd goals. Investigations may be on an area-wide basis or be herd specific dependent on each situation.

The changes from the present management strategy are being proposed for these reasons:

1. Depredation is increasing in some areas.
2. Annual production is declining in some areas.
3. Recent data indicate that the past hunting zone boundaries did not accurately reflect those of the herds.

The Department's Wildlife Management Administrative Report No. 77-2, The Pronghorn Antelope in Northeastern California, (Pyshora 1977), includes information on characteristics, populations, fences, life history, reproduction, history and distribution, special hunts, and transplanting. The Interstate Antelope Conference Guidelines, revised by Salwasser (1980), covers all aspects of herd unit planning, herd management techniques, habitat management techniques, management of human activities, predator management, research news, and life history and habitat needs. The Department's Antelope Depredation Contingency Plan, July, 1978, (Appendix 5), includes guidelines for handling depredation. These three documents provide the basis for pronghorn herd management. Herd management plans will include little of the information in this reference material, since these references are readily available.

The pronghorn population increase, plus increased acreage developed for agriculture, primarily alfalfa, has resulted in the increased depredation complaints. In 1977, 77 pronghorn were trapped and relocated to correct a chronic depredation of alfalfa. These complaints prompted development of the Antelope Depredation Contingency Plan. The plan emphasizes three factors which limit the Department's effectiveness in dealing with the problem: 1) the Department is prohibited by state law from issuing depredation permits, 2) relocating pronghorn is very costly, and 3) suitable relocation sites are scarce.

Herd boundaries are based on the most current knowledge; however, some interchange of animals between Management Units does exist. The magnitude of these interchanges needs to be further defined in some areas. Pronghorn are continuing to expand their range west and south, which may eventually require redefining herd boundaries. However, available data are adequate to proceed with herd management.

For each herd, habitat and population data are presented and management objectives and strategies are defined.

MOUNT DOME HERD

Management Unit 1

Area Description (Figure 1-1)

Beginning at the junction of Interstate 5 and the California-Oregon state line; east along the California-Oregon state line to the Ainsworth Corners-Lava Bed National Monument road; south along the Ainsworth Corners-Lava Beds National Monument road to the Mammoth Crater-Medicine Lake road; southwest along the Mammoth Crater-Medicine Lake road to the Medicine Lake-Telephone Flat road; east and south along the Medicine Lake-Telephone Flat road to the Telephone Flat-Bartle road; southwest along the Telephone Flat-Bartle road to Highway 89; west along Highway 89 to Interstate 5; north along Interstate 5 to the California-Oregon state line.

Land Ownership

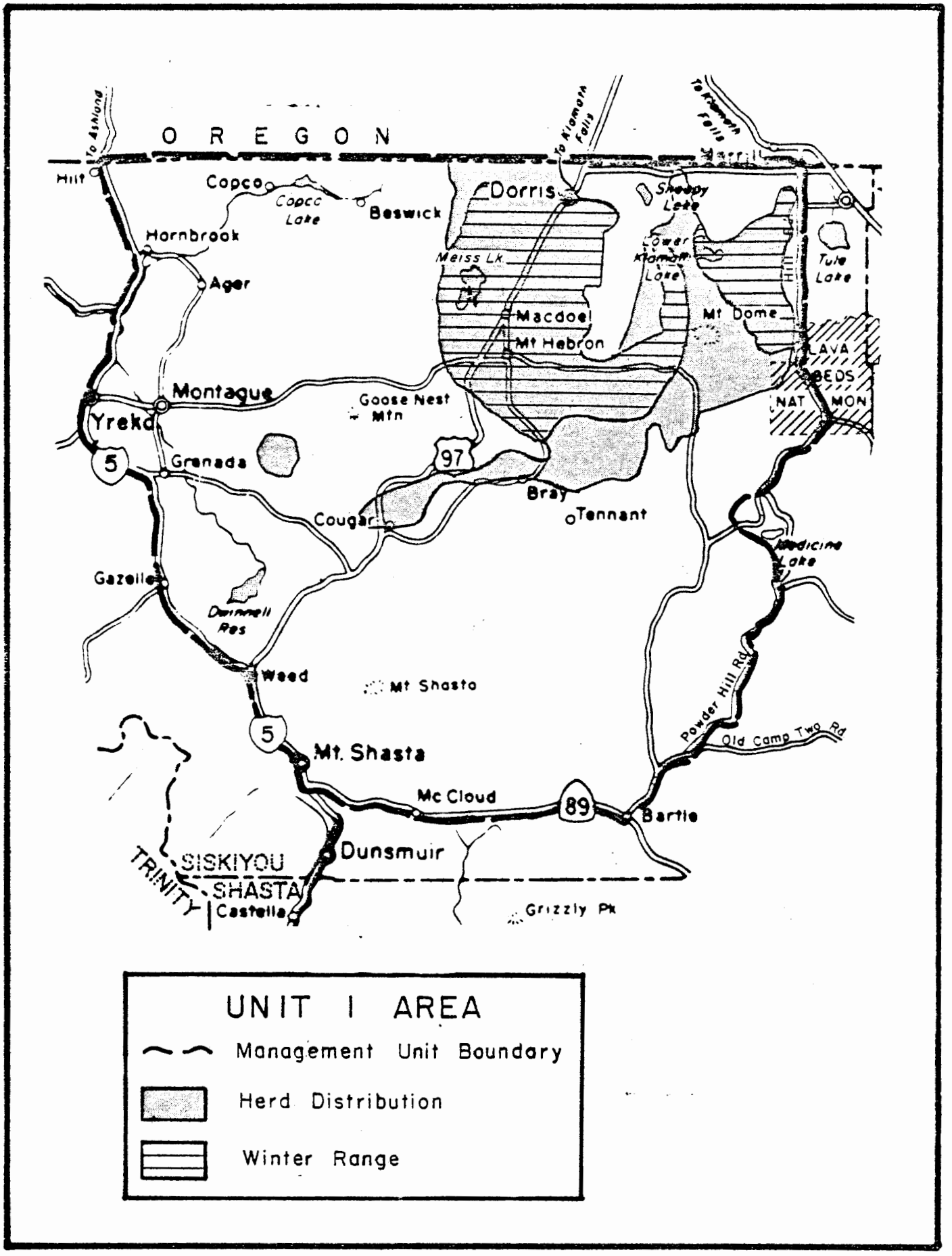
The herd area contains about 255,000 acres of range used by pronghorn. Land ownership in this area is approximately as follows:

TABLE 1-1

Land Ownership-Unit 1

Ownership	Range Area		Percent
	Hectares	Acres	
Private	50,182	124,000	49
U.S. Forest Service	23,068	57,000	22
U.S. Bureau of Land Mgmt.	14,569	36,000	14
U.S. Fish & Wildlife Serv.	14,974	37,000	15
National Park Service	405	1,000	Trace
	103,198	255,000	100

FIGURE I-1


OREGON
To Ashland
To Klamath Falls
To Klamath Falls
Hilt
Copco
Copco Lake
Beswick
Dorris
Shoddy Lake
Hornbrook
Meiss Lk
Lower Klamath Lake
Tule Lake
Ager
Macdoel
Mt Dome
Mt Hebron
LAVA BEDS NAT MON
Montague
Goose Nest Mtn
Yreka
5
Granada
97
Bray
Cougar
Tennant
Medicine Lake
Gazelle
Dwinnell Res
Weed
Mt Shasta
5
Mt. Shasta
Powder Hill Rd
Old Camp Two Rd
Mc Cloud
89
Bartle
TRINITY
SISKIYOU
SHASTA
Castella
Dunsmuir
Grizzly Pk
UNIT I AREA
Management Unit Boundary
Herd Distribution
Winter Range

Land Uses

Livestock grazing and timber production are the major commercial uses of public lands here. Public waterfowl refuges are devoted to providing habitat for waterfowl. Arable private lands are devoted to irrigated crops where water is available or can be developed. Some timber and grazing lands are privately owned.

Changes in land use that may affect pronghorn primarily are agricultural expansion and rural residential development. Agricultural expansion is presently occurring. Recreational housing developments have been restricted to areas not important to pronghorn, but the threat of expansion into pronghorn range must be considered. Geothermal energy exploration and development also are potential land use changes that could adversely affect pronghorn.

Vegetation, Soils and Water Availability

The range used by pronghorn includes most of the agricultural lands in the Butte Valley and Red Rock Valley areas. However, the predominant pronghorn range is sage-grassland, interspersed with juniper in some localities. Timbered areas in the southern and western portions of the unit are not used by pronghorn. Agricultural lands in the Tulelake Basin and Lower Klamath Lake areas likewise receive very little pronghorn use. Pronghorn have begun to extend their range westward as indicated by several observations in Shasta Valley.

Agriculture consists mainly of irrigated alfalfa and potatoes. Onions, barley, and irrigated pasture are less prevalent crops. Some dry land grain farming is also practiced. The Lower Klamath and Tulelake areas contain large waterfowl refuges. On these areas, emphasis is placed on cereal grain crops. The higher precipitation areas in the southern and western portions of the unit are

timbered. Yellow pine, white fir, and lodgepole pine predominate in timbered areas. The remainder of the unit is sage-grassland interspersed with juniper and curl-leaf mahogany at higher elevations. Big sage and cheatgrass are the predominant vegetation in sage-grassland areas. Other browse types, such as bitterbrush, silver sage, low sage, black sage, saltbush, rabbitbrush, snowberry, and serviceberry occur, but except for sages, bitterbrush is the only other browse important to pronghorn. Perennial grasses, such as Idaho fescue, squirrel tail, great basin wild rye, and blue bunch wheatgrass occur, but are not important pronghorn forage. Next to browse, forbs rank highly. Tumbling mustard, poverty weed, prickly lettuce, russian thistle, plus more than 50 other forb types occur here and are used by pronghorn.

The agricultural lands in Butte Valley and Red Rock Valley are valley basin soils from lake deposits. The remainder of the range is primarily terrace and upland soils.

Precipitation ranges from 30.5 to 50.8 centimetres (12 to 20 inches) with the heaviest precipitation occurring in the western part of the unit. Precipitation occurs primarily from October through April, mostly as snow. Summer thundershowers occur sporadically, but have little influence on forage or water supplies.

Surface water is limited in sage-grass areas. Stock tanks and vernal lakes supply much of the water needed by pronghorn there during summer and fall. Drought conditions may cause some shifting of pronghorn to obtain water in non-agricultural areas.

Habitat Status

Pronghorn habitat in the Red Rock/Macdoel area is undergoing change. The expansion of agriculture, primarily alfalfa, has resulted in some sage and

sage/juniper lands being converted to crop land. Wheel line irrigation and increased alfalfa prices have contributed to this expansion. In Butte Valley, USFS provide relatively undisturbed sage/grass habitat.

The Big Tableland and the area east of Mount Dome are sage/grassland with some juniper. The BLM has converted some of this area to perennial grasses.

Population Trend

The Mount Dome herd has increased more rapidly than any of the other northeastern California herds (Figure 1-2). The population increased from an average of about 100 animals during the mid-century period to the 1981 population of 994, nearly a ten-fold increase. Buck and kid ratios per 100 does have averaged higher than average for the northeastern population (Figure 1-3). Reasons for this population increase and the better buck and kid ratios are unknown. However, changes in livestock grazing use may have had an effect. Increased acreage of crop lands, primarily alfalfa in Butte and Red Rock Valleys is felt to have been of major benefit to pronghorn.

As the population increases, some range extension is occurring. A small group of animals now summers in the Fawn Lodge area about 32 kilometres (20 miles) southwest of Macdoel. Animals have also been observed in Shasta Valley in recent years.

Pronghorn in this herd area are essentially non-migratory. There is evidence that some animals move between this herd and the Clear Lake herd range. The information available indicates that this shift is rare, however.

Buck harvest from this herd has been increasing each year since 1975. This increase has been the most rapid of any of the herds.

FIGURE 1-2

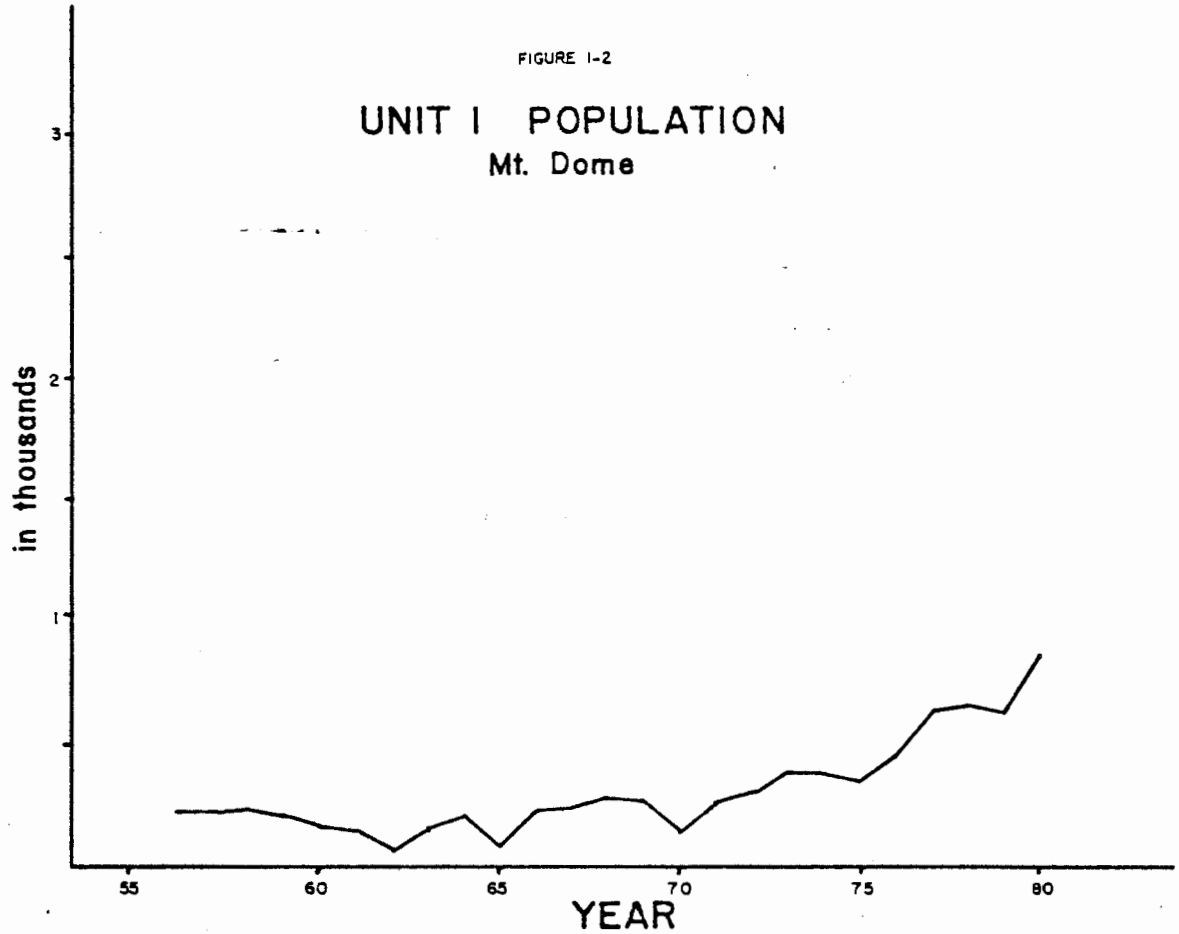
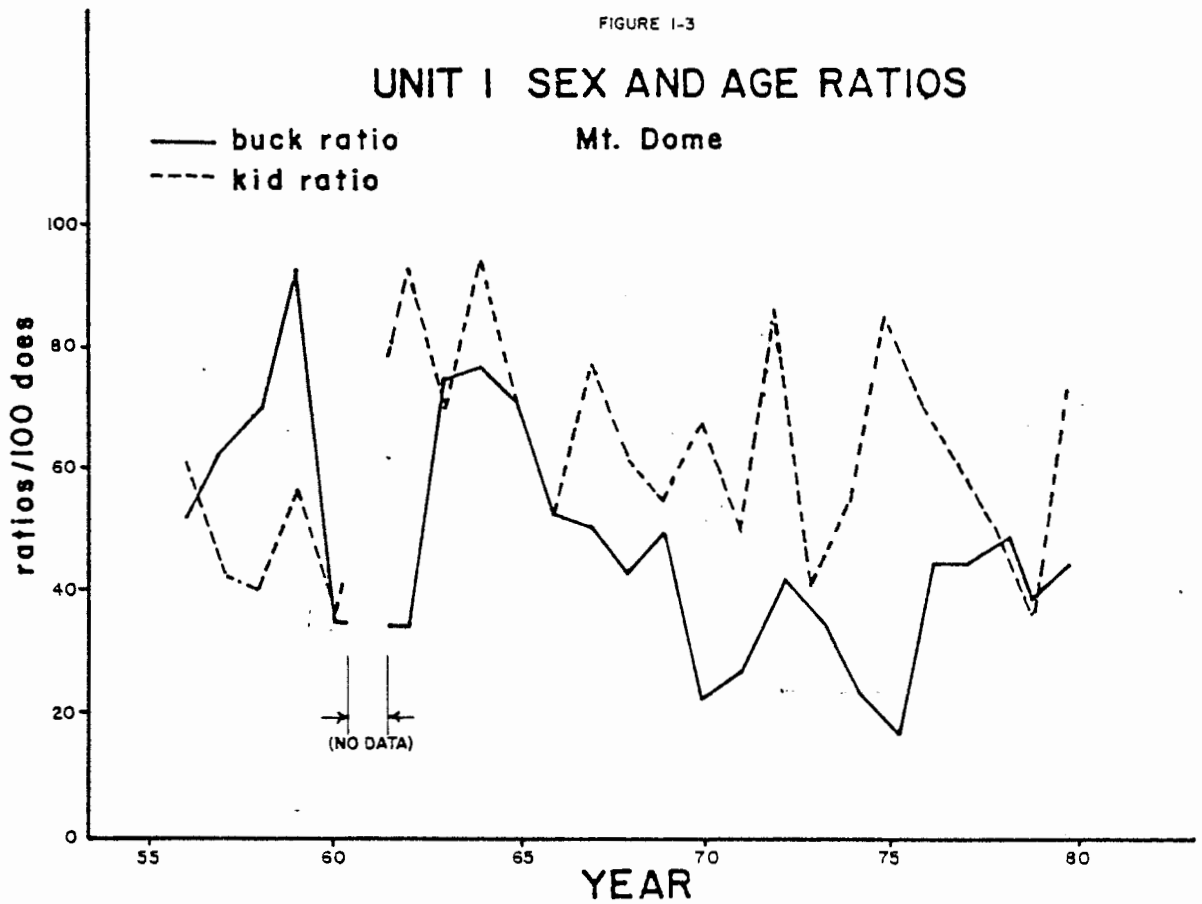


FIGURE 1-3



Management efforts have been limited to annual herd composition and census surveys, mapping kidding areas, and the special hunt program. Land management agency program proposals are monitored and commented on regarding their impacts on pronghorn and other wildlife. County land use plans, zoning, and land use change proposals are watched carefully and opposed if they could have a detrimental effect on pronghorn.

Pronghorn use croplands for foraging, which results in some depredation. Consequently, ranchers are requesting relief from this depredation.

Objectives

1. Manage the Mount Dome population at the level of 500 animals and the Red Rock Valley/Butte Valley population at 500 animals.
2. Maintain herd ratios of at least 40 bucks and 60 kids per 100 does at the time of the herd composition surveys in July for both populations.

The first objective will require reducing the Red Rock/Butte Valley population by 160 animals. This reduction is designed to control pronghorn depredation at an acceptable level. The objective for the Mount Dome population is to increase the population by 166 pronghorns. Both objectives are based on 1981 census data. Depredation at this time is not a serious problem in the Mount Dome area.

Management Strategies

Control the population at 500 each in the Red Rock/Butte Valley, and the Mount Dome areas by: (a) hunter harvest during regularly scheduled seasons, (b) special hunts if required to control depredation, and (c) trapping and relocating (if suitable sites are available).

County, state, and federal land use plans, zoning changes, and habitat manipulation project proposals will be monitored and supported or opposed depending on their anticipated effect on pronghorn.

Inventory and Investigation

The present aerial herd composition and census surveys will be continued. In addition, aerial surveys to locate and map kidding areas will be conducted periodically to update information.

It should be determined if a movement of animals occurs between the Mount Dome and Clear Lake herds, and if it occurs what the magnitude is. If intra unit movement is occurring, a change in management strategy may be necessary.

Herd Management and Mortality Control

The Mount Dome herd displays a comparatively high reproductive rate. The population has increased more rapidly than any of the other herds, indicating that the habitat in its present condition is at least satisfactory. The high kid survival rate is probably due to high quality forage (alfalfa) provided by expanding farming in the Red Rock/Butte Valley area.

Habitat Modification

No habitat modifications specifically designed for pronghorn are proposed. The present habitat is adequate to meet present herd objectives. This does not preclude such developments in the future dependent on herd responses and/or habitat changes.

Law Enforcement

There is no evidence of, or reports of, substantial illegal killing, indicating that no increase in law enforcement in this area is necessary.

Communication of Information

The present news release system to report results of herd surveys and the annual hunt will be continued. In addition, this proposed management plan will be aired publicly at meetings within the planning area, and possibly outside the area. These meetings will be used to secure public input and to test public acceptance of the management proposals.

Review and Update

Additional data will be added to the computer model annually, at which time an assessment will be made of how the program conforms to herd objectives. Management changes will be made to meet objectives. Major plan revisions will be made at five-year intervals, including goals and objectives if necessary.

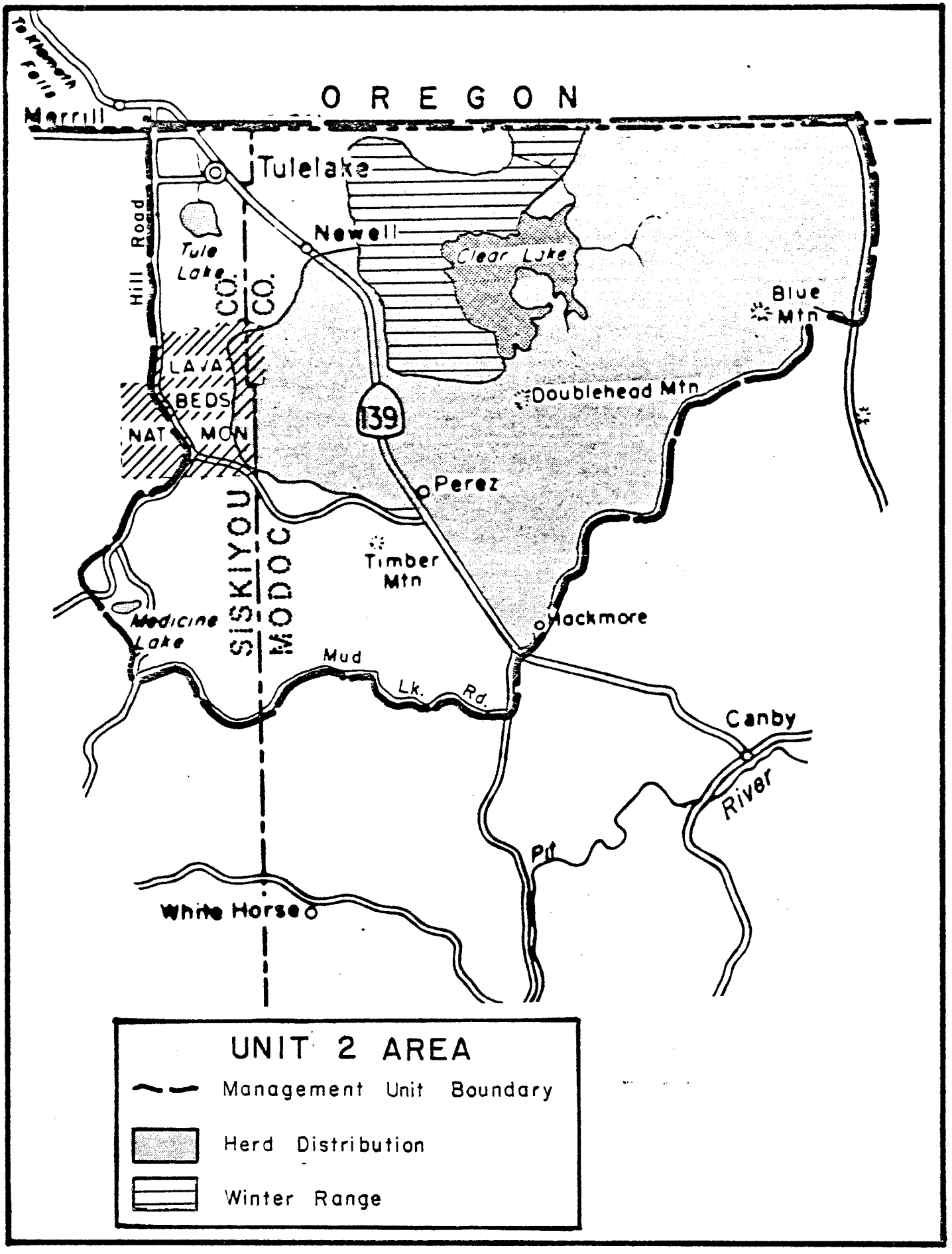
CLEAR LAKE HERD

Management Unit 2

Area Description (Figure 2-1)

Beginning at the junction of the Lava Beds National Monument road and the California-Oregon state line at Ainsworth Corners; east along the state line to the Crowder Flat road; south along the Crowder Flat road to Modoc County Road 73; south along Modoc County Road 73 to Modoc County Road 136; west along Modoc County Road 136 to the Blue Mountain-Mowitz road; west and south along the Blue Mountain-Mowitz road to the Deadhorse Flat-Badger Well road; southwest along the Deadhorse Flat-Badger Well road to the Badger Well-Browns Well road; south along the Badger Well-Browns Well road to the Sorholus Tank-Hackmore road; southwest along the Sorholus Tank-Hackamore road to Highway 139; southeast along Highway 139 to Modoc County Road 91; south along Modoc County Road 91 to the Mud Lake-Mud Springs road; west along the Mud Lake-Mud Springs road to the North Main Road; southwest along the North Main Road to the Long Bell-Iodine Prairie road at Long Bell Forest Service Station; northwest along the Long Bell-Iodine Prairie road to the Bartle-Telephone-Flat road; north along the Bartle-Telephone-Flat road to the Telephone Flat-Medicine Lake road; north and west along the Telephone Flat-Medicine Lake road to the Medicine Lake-Mammoth Crater road; northeast along the Medicine Lake-Mammoth Crater road to the Lava Beds National Monument-Ainsworth Corners road; north along the Lava Beds National Monument-Ainsworth Corners road to the California-Oregon state line.

FIGURE 2-1


OREGON
Merrill
Tulelake
Newell
Hill Road
Tule Lake
Clear Lake
Blue Mtn
LAVA BEDS NAT MON
Doublehead Mtn
139
Perez
SISKIYOU CO.
MODOC CO.
Timber Mtn
Medicine Lake
Hackmore
Mud Lk. Rd.
Canby
River
Pit
White Horse
UNIT 2 AREA
Management Unit Boundary
Herd Distribution
Winter Range

Land Ownership

This unit contains about 481,000 acres of range used by pronghorn. Approximate land ownership is as follows:

TABLE 2-1

Land Ownership-Unit 2
Range Area

Ownership	Hectares	Acres	Percent
U.S. Forest Service	153,072	378,240	78.7
U.S. Fish & Wildlife Serv.	12,691	31,360	6.5
Private	26,418	65,280	13.6
U.S. Bureau of Land Mgmt.	2,331	5,760	1.2
	194,512	480,640	100.0

Land Uses

Agriculture consists mainly of irrigated alfalfa and potatoes. Some dry land grain farming is practiced and there is a limited amount of irrigated pasture. Some meadow hay is also grown. Yellow pine is the dominant timber type. Some curl-leaf mahogany occurs at higher elevations in the sage-grass type. Forbs are also abundant in the sage-grassland. Sage species and forbs are primary pronghorn forage.

Livestock grazing, timber production, and irrigated agricultural crops are major commercial land uses in this unit. The Clear Lake National Wildlife Refuge is managed primarily as a breeding area for water associated bird species. No agriculture is practiced on this refuge.

Vegetation, Soils, Water Availability

The range used by pronghorn is primarily sage-grassland interspersed with juniper in some areas. Timbered areas in the southern and eastern portions of

the unit are lightly used by pronghorn. Agricultural areas in the western part of the unit are also lightly used.

The soils in the Tulelake and Clear Lake areas are valley basin soils formed by lake deposits. The remainder of the pronghorn range is terrace and upland soils.

Precipitation ranges from 25.4 to 30.5 centimetres (10 to 12 inches) annually and occurs primarily as snow during the period from October through April. Summer thundershowers occur sporadically, but are of little consequence.

Surface water is limited in non-agricultural areas. Stock tanks, one large reservoir, a few streams and vernal lakes provide pronghorn water. Some locations become water deficient in late summer, especially during years of below normal precipitation.

Habitat Status

Changes in land use to date has been the expansion of agriculture into pronghorn range. Wheel line irrigation has allowed landowners to expand operation into arable soil areas east of the Tulelake Basin. These operations are converting sage-grassland into irrigated alfalfa on pronghorn winter range. The effect of this land use change on pronghorn is not known.

The Modoc National Forest has converted a substantial area of sage-grassland to perennial grass. The effect of these conversions is also not known.

Population Trend

The population has increased from a low of 316 in 1960 to a relatively stable average of 1,250 animals for the past nine years. During the period from 1967

through 1973, this herd increased in numbers more rapidly than any other herd (Figure 2-2). This was probably due to an intensive coyote control program by a local sheep rancher. The rancher acquired a helicopter and aerially gunned 530 coyotes during the lambing seasons of 1967 through 1970. During the period of 1966 through 1973, pronghorn kid ratios averaged 85 per 100 does, which was much higher than any of the other herd production (Figure 2-3). Despite this rapid short-term increase, the long-term population trend is below the northeastern California average. In 1980, kid production here was the lowest of any herd.

Pronghorn in this unit are migratory, moving from summer ranges south, east, and in the vicinity of Clear Lake, to winter range in the hills bordering the east side of the Tulelake Basin.

Buck harvest has been declining since the high of 66 animals during the 1973 season.

Management efforts include annual census and herd composition surveys, the special buck hunting program, and periodic aerial kidding ground surveys. County and federal land use change proposals are monitored and supported or opposed depending on their potential impacts on pronghorn.

Pronghorn use of crop lands in this unit is minimal. No depredation problems have been reported.

Objectives

1. Manage the population at about 1,350.
2. Maintain herd ratios of at least 35 bucks and 60 kids per 100 does at the time of July herd composition surveys.

The population objective can be maintained by improving kid production.

FIGURE 2-2

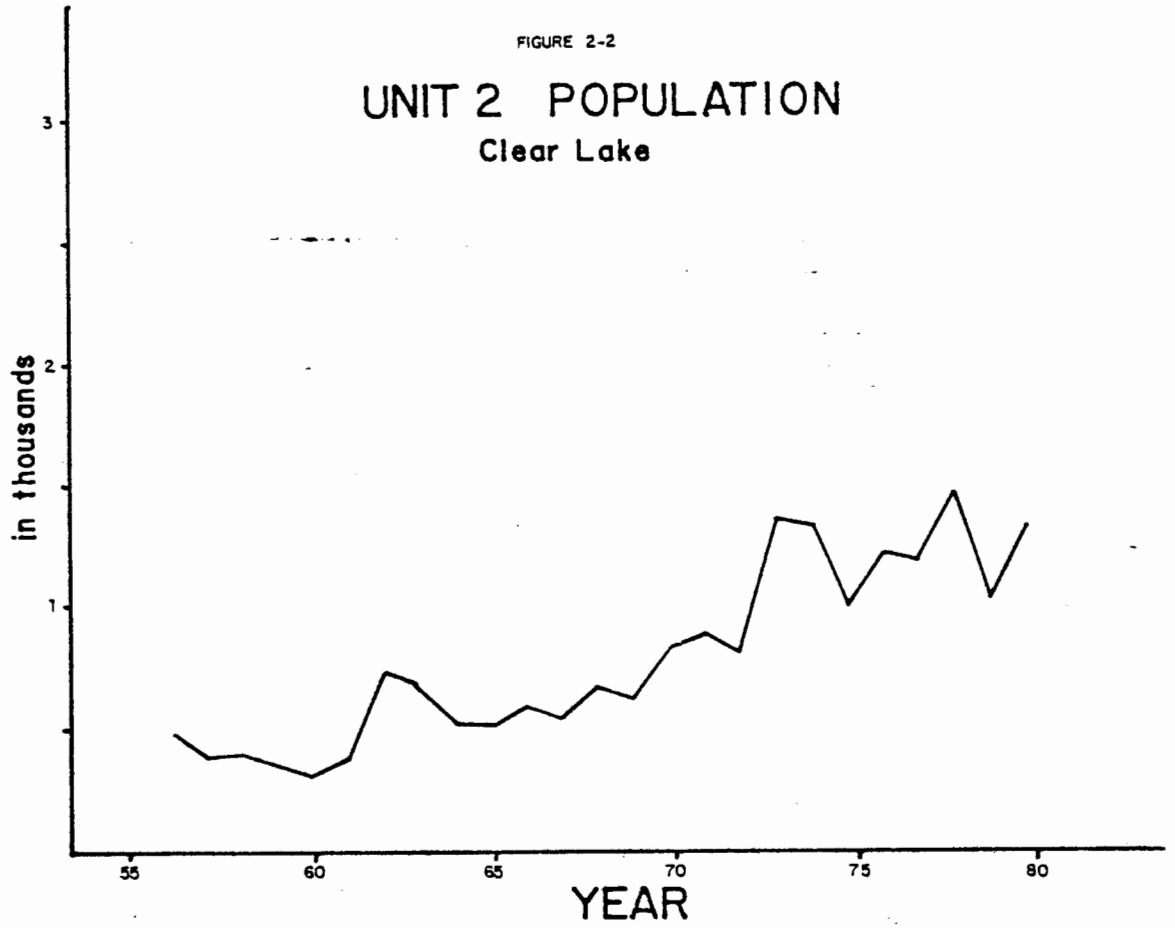
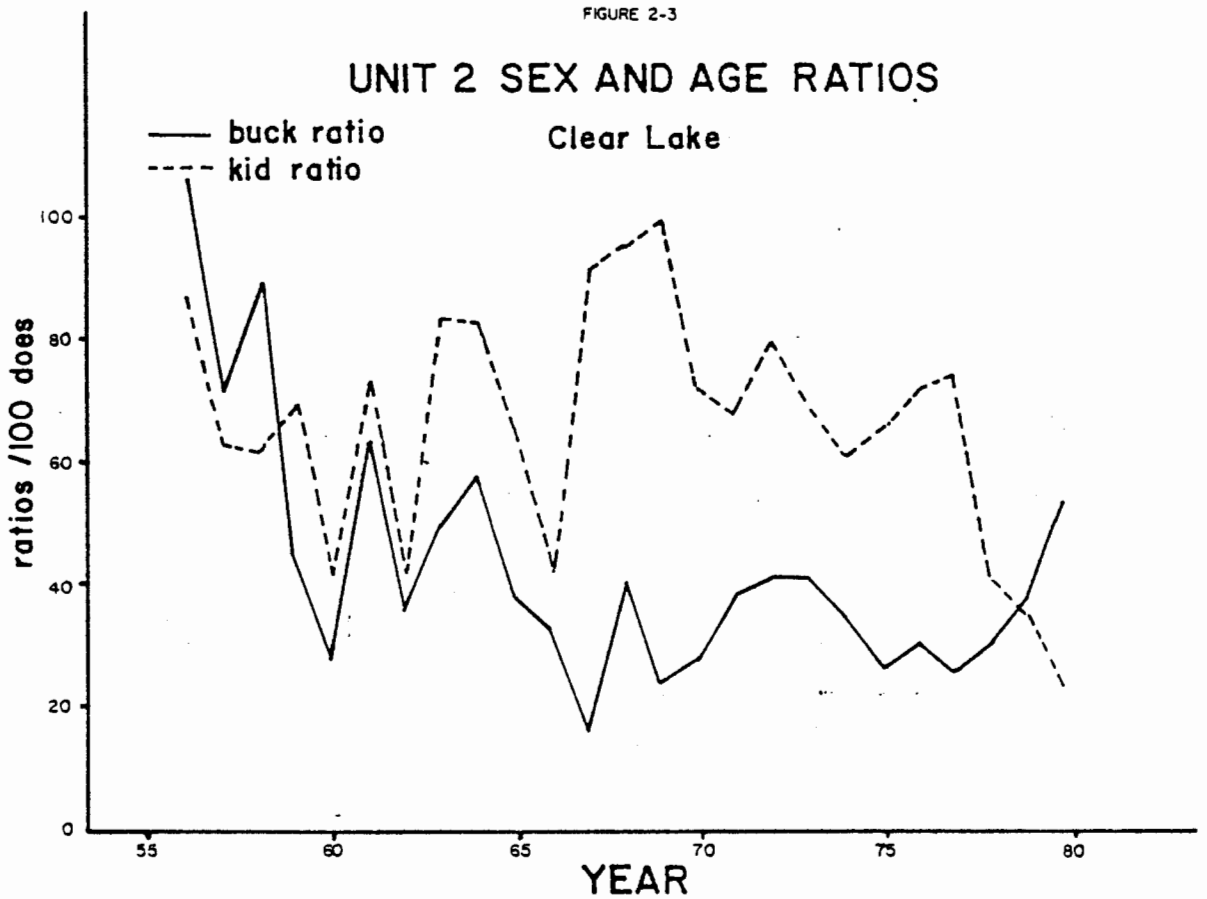


FIGURE 2-3



The herd ratio objectives will require a reversal of the downward trend in kid survival.

Management Strategies

1. Maintain the population at about 1,350 by: (a) A hunter harvest during regularly scheduled seasons, and/or (b) trapping and relocating (if suitable sites are available).

Hunter harvest will be the primary means of population control. If suitable sites are located and other herds cannot supply sufficient animals, trapping and relocating will be undertaken. Other herds with depredation problems will be highest priority areas for trapping and relocating.

Kid survival must be improved to meet the herd ratio objective and to maintain the population objective. Coyote control should be tested as a method of improving kid survival. Based on past experience, coyote control can bring about dramatic short-term increases in kid survival and population. If predator control is successful in increasing kid ratios, then increased hunter harvest will be necessary to meet the herd size objective.

Inventory and Investigation

The present census and herd composition surveys will be continued. Periodic aerial kidding ground surveys will be undertaken to locate and map changes in these critical habitat areas.

Herd Management and Mortality Control

Hunting will be the primary means of maintaining the population at the desired level. The number of permits for each sex will be based on herd ratio objectives.

If a need arises to reestablish populations elsewhere in California or other western states, animals in excess of the herd size objectives may be trapped and relocated.

Predator control will be tested as a means of increasing kid ratios.

Continue with the present controlled hunter and harvest program on the Clear Lake Refuge in cooperation with the Fish and Wildlife Service.

Habitat Modification

No habitat projects designed specifically for pronghorn are proposed. In the future, such projects may be recommended dependent on herd response to management efforts. Federal land management agencies will be encouraged to improve habitat for pronghorn with assistance from the Department.

County, state, and federal land use plans will be closely monitored to determine their potential effects on pronghorn. These projects will be supported or opposed dependent on their potential effect.

The decline in kid ratios in this herd may be due in part to habitat changes. Pronghorn do not prosper on perennial grass ranges or any other range type unless sufficient forbs are available.

Law Enforcement

There is no indication that illegal hunting has a significant impact on this herd. No increase in enforcement effort is necessary at this time.

Communication of Information

The present news releases regarding results of herd surveys and hunts will be continued. This management plan will be aired with federal land management

agencies and the general public to secure recommendations and to advise of our proposed management strategies.

Review and Update

The computer model will be updated as herd survey data becomes available. Changes in objectives and management strategies will be proposed as necessary to meet current situations. Major plan revisions will be made at five-year intervals as necessary.

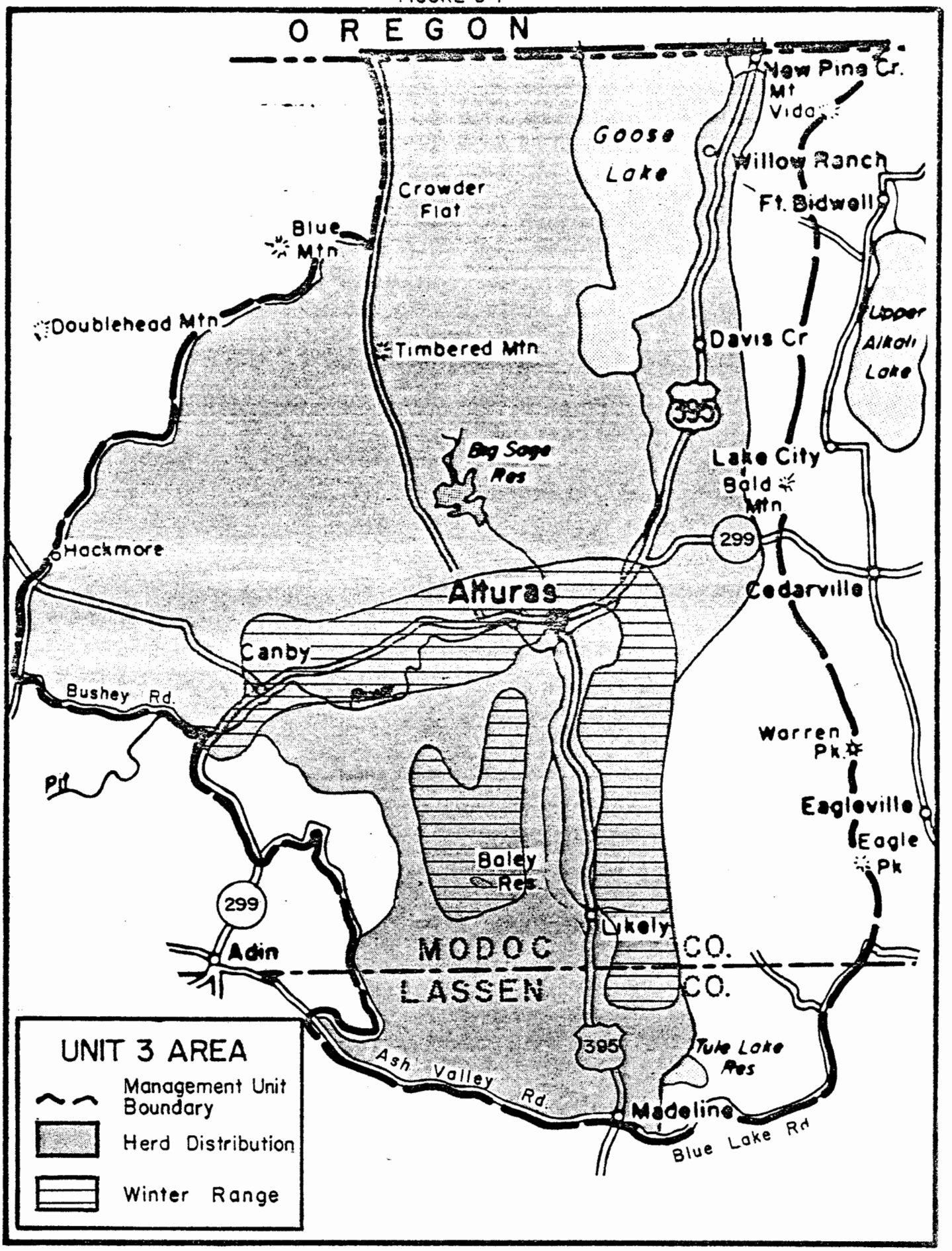
LIKELY TABLES HERD

Management Unit 3

Area Description (Figure 3-1)

Beginning at the junction of the Crowder Flat road and the California-Oregon state line; east along the state line to the crest of the Warner Mountains; south along the crest of the Warner Mountains to the Summit Trail at Pepperdine Camp; south along the Summit Trail to the South Warner road near Patterson Forest Service Station; west along the South Warner road to the Long Valley-Clarks Valley road; south along the Long Valley-Clarks Valley road to the Clarks Valley-Madeline road; west along the Clarks Valley-Madeline road to Highway 395 at the town of Madeline; north along Highway 395 to the Madeline-Adin road; northwest along the Madeline-Adin road to the Hunsinger Draw-Sweagert Flat road; east and north along the Hunsinger Draw-Sweagert Flat road to the Sweagert Flat-Hunters Ridge road; north and west along the Sweagert Flat-Hunters Ridge road to Highway 299 near Lower Rush Creek Recreation Site; north along Highway 299 to the Canby Bridge-Cottonwood Flat road; northwest along the Canby Bridge-Cottonwood Flat road to the Cottonwood Flat-Happy Camp road; northwest along the Cottonwood Flat-Happy Camp road to Modoc County Road 91; north along Modoc County Road 91 to Highway 139; north along Highway 139 to the Hackamore-Sorholus Tank road; northeast along the Hackamore-Sorholus Tank road to the Browns Well-Badger Well road; north along the Browns Well-Badger Well road to the Badger Well-Deadhorse Flat road; northeast and east along the Badger Well-Deadhorse Flat road to the Mowitz-Blue Mountain road; north and east along the Mowitz-Blue Mountain road to Modoc County Road 136; east along Modoc County Road 136 to Modoc County Road 73; north along Modoc County Road 73 to the Crowder Flat road; north along the Crowder Flat road to the California-Oregon state line.

FIGURE 3-1


OREGON
New Pine Cr.
Mt
Vida
Goose
Lake
Willow Ranch
Ft. Bidwell
Crowder
Flat
Blue
Mtn
Doublehead Mtn
Timbered Mtn
Upper
Alkali
Lake
Davis Cr
395
Big Sage
Res
Lake City
Bald
Mtn
299
Hackmore
Alturas
Cedarville
Canby
Bushey Rd.
Warren
Pk.
Eagleville
Eagle
Pk
Baley
Res
299
Adin
Likely
MODOC CO.
LASSEN CO.
395
Tule Lake
Res
Ash Valley Rd.
Madeline
Blue Lake Rd
UNIT 3 AREA
Management Unit
Boundary
Herd Distribution
Winter Range

Land Ownership

Approximately 825,000 acres of this unit are used by pronghorn. Of this acreage, about 70 percent is public land. Approximate land ownership is as follows:

TABLE 3-1

Land Ownership-Unit 3
Range Area

Land Owner	Hectares	Acres	Percent
U.S. Forest Service	176,042	435,000	53
U.S. Bureau of Land Mgmt.	58,681	145,000	17
Private	96,317	238,000	29
U.S. Bureau of Indian Affairs	2,833	7,000	1
	333,873	825,000	100

Land Uses

Livestock grazing, timber production, and recreation are the major public land uses. The Modoc National Forest, in cooperation with the Department, has an ongoing program of waterfowl breeding area improvement on pronghorn summer range. Arable private lands are primarily used for hay production, predominantly irrigated alfalfa. Some dry land hay farming is also practiced. Most of the hay produced is used for beef cattle feeds on local base ranches, but an increasing amount is being sold to out of county users.

Vegetation, Soils, Water Availability

Summer range is primarily federally administered lands in the Devil's Garden and Likely Tables areas. Some of this herd summers on or near agricultural lands in the Goose Lake Valley and Warm Springs Valley. Wintering areas are largely Bureau of Land Management lands on Likely Tables and Rocky Prairie.

The Goose Lake Valley and Warm Springs Valley areas are composed of Valley Basin soils. Primary pronghorn use areas are on terrace and upland soils. The Warner Mountains contain some Pre-Cambrian to recent rock complex, but are not part of the pronghorn range.

Precipitation is generally winter snow ranging from 25.4 to 51 centimetres (10 to 20 inches) annually. The heaviest precipitation occurs in the Warner Mountains and in the higher elevation timbered areas south of Canby.

Surface water is normally adequate for pronghorn. Reservoirs, streams, and a few large springs provide most of this water.

Agricultural crops are chiefly irrigated alfalfa and meadow hay. Some cereal grain is grown, primarily in Goose Lake Valley. The Devil's Garden area is a juniper forest interspersed with large sage flats, meadows, and reservoirs. It is bordered on the north with yellow pine timber. Silver sage, low sage, annual and perennial grasses, and forbs are major ground covers there. The Likely Tables is a big sage, low sage, annual grass and forb area. Seeded perennial grasses cover a portion of the private land on the south end of the tables. Rocky prairie is primarily juniper interspersed with large sage-grass flats, and cheatgrass is the dominant annual grass. Forbs include a great variety of annuals.

Habitat Status

Agriculture, primarily irrigated alfalfa, has encroached into pronghorn habitat in the Goose Lake and Warm Springs Valley areas in former sage-grass range. The effects on pronghorn are unknown. Extensive invasions of medusa head, an aggressive, unpalatable grass on the likely tables, and of juniper on Rocky Prairie and the Devels Garden are detrimental to pronghorn range.

Urban expansion, especially recreational subdivisions, have usurped some pronghorn range in the Alturas/Canby area.

Population Trend

The Likely Tables' herd size has increased four-fold since 1960: from 554 to 2,250 animals. This area contains the largest pronghorn population of any herd in northeastern California (Figure 3-2). Kid survival has been on a declining trend since 1970, as have buck ratios (Figure 3-3). Reasons for these declines are not well known, but forage changes such as the increase in medusa head may have contributed.

Some pronghorn in this unit are migratory, moving from summer areas to winter on the Likely Tables and on Rocky Prairie. These areas also contain substantial resident populations of pronghorn.

Migratory pronghorn primarily summer on USFS land and winter on BLM land. There are some animals that summer on private land and a few that winter there. This unit is one where pronghorn depredation is occurring; damage is primarily to alfalfa in the Goose Lake and Alturas areas. The Department relocated 77 animals from an alfalfa field east of Goose Lake in 1977 when depredation became intolerable to the landowner. Other depredation complaints have been received.

There is apparently some migration between the Likely Tables and Lassen herds, probably between Likely Tables and the Madeline Plains. More pronghorn winter in this unit than summer here, and hunting season permit ratios are adjusted to compensate for this migration. Additional data are needed to determine the extent of this inter-herd movement.

FIGURE 3-2

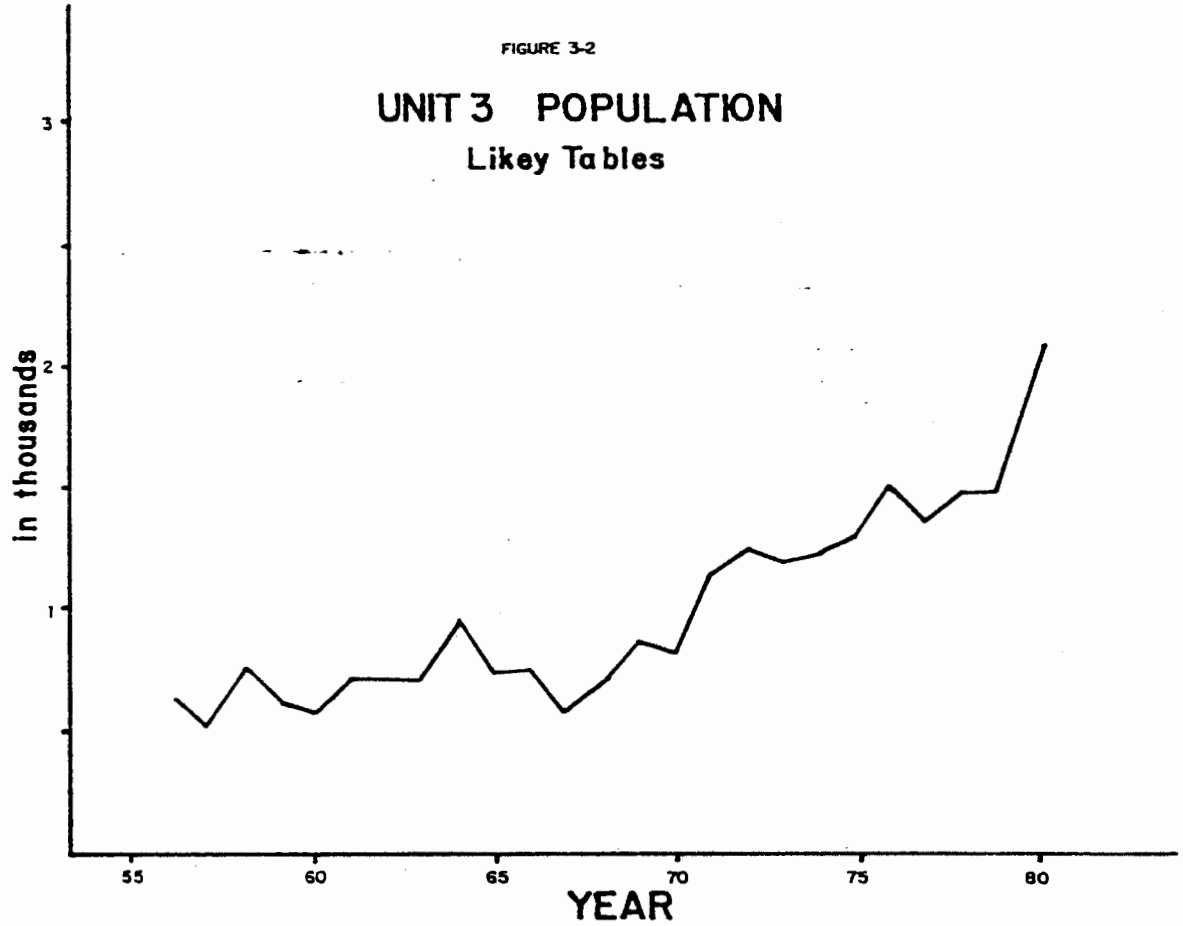
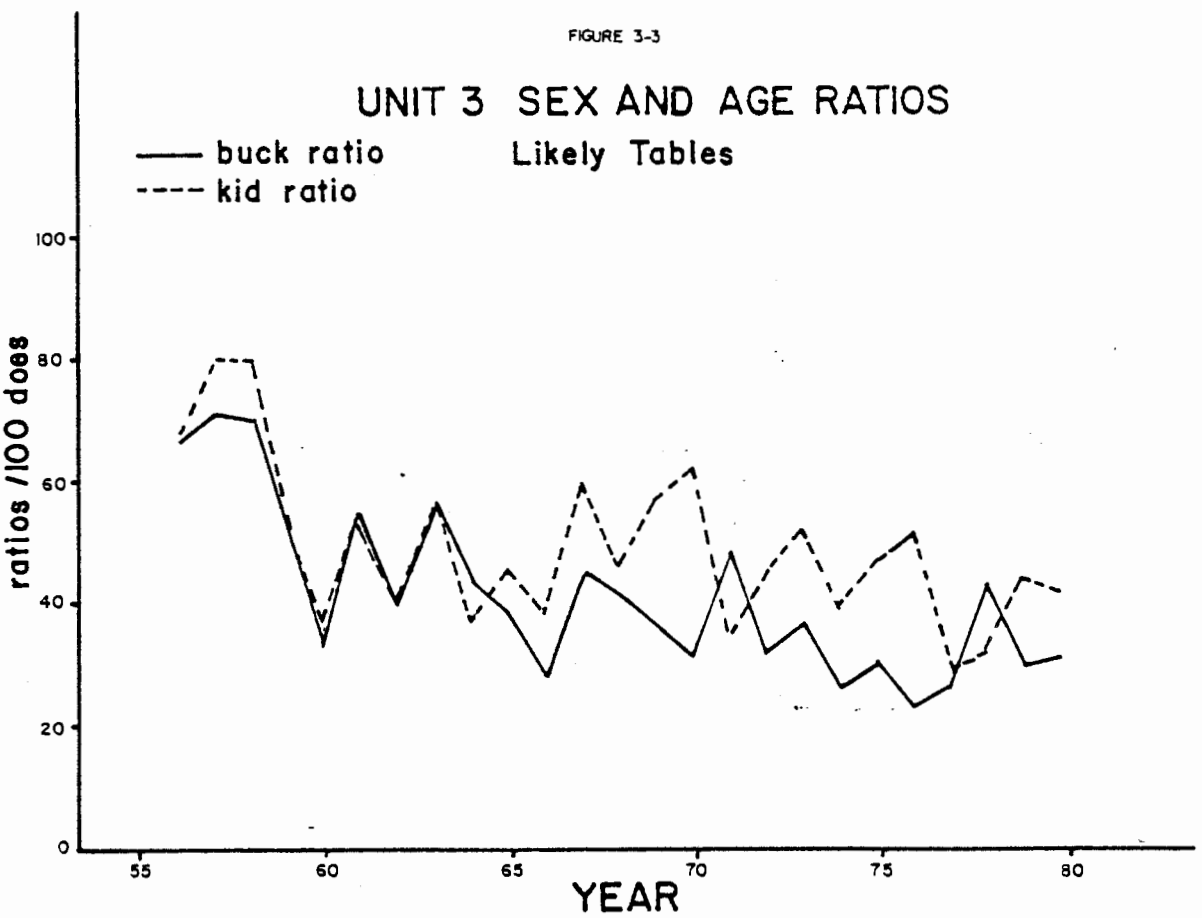


FIGURE 3-3



Competition with domestic grazing animals and wild horses for forage and perhaps water is felt to be a problem. Areas used heavily by wild horses have recently yielded low kid ratios. "Feral horse competition is suspected as a factor in the low subherd [herd] performance" (Salwasser and Shimamoto 1979).

Migration routes to and from summer ranges in the Devil's Garden and Davis Creek areas are restricted to very specific paths, especially where these animals cross Highways 395 and 299 East. Any change in land use at these specific sites and possibly along any area of fall migration routes could have a severe adverse impact on this herd.

Objectives

1. Maintain wintering populations of 450 pronghorn on the Rocky Prairie winter range, and 1,700 on the Likely Tables winter range.
2. Maintain herd ratios of 35 bucks and 50 kids per 100 does at the time of the summer herd composition survey.

The population objective can be maintained if the kid ratio objective, which is higher than recent surveys indicate, is met or exceeded. A range management program which considers adequate pronghorn forage allotments, should allow the kid ratio to improve. Buck ratios will also increase as more kids are produced.

Management Strategies

1. Improve kid and buck ratios by:
    a. Working with federal land management agencies to encourage adequate consideration for pronghorn in grazing allotment management plans.
    b. Controlling the population within what the habitat can support in a productive manner.

c. Participating in habitat programs that will benefit pronghorns.

2. Control the pronghorn population within the herd size objective by:

(a) Hunter harvest during regularly scheduled seasons, and/or,

(b) special depredation hunts if damage control is necessary, and/or,

(c) trapping and relocating (if suitable sites are available).

Hunting will be the primary means of maintaining the population at the desired management level. The numbers of permits for each sex will be based on herd ratio objectives.

If a need arises to reestablish populations elsewhere in California or other western states, animals in excess of the herd size objectives may be trapped and relocated.

Inventory and Investigation

Aerial census and herd composition surveys will be continued. Periodic aerial kidding ground surveys will be undertaken for their locations and mapping.

The influx of animals during the winter, presumably from the Lassen herd, needs to be investigated. This inter-herd movement requires adjustment of buck permits downward for this unit, as more pronghorn winter than summer here. If the buck permit quota were based on the census, then the number of permits issued would be too high (Appendix 4). This formula will be revised to fit additional units.

County, state, and federal land use and/or zoning change proposals will be closely monitored. Any proposal that would adversely affect pronghorn will be opposed.

Assistance will be offered to land managers with habitat improvements to benefit pronghorn.

Control of wild horse populations on federal range lands will be encouraged.

Herd Management and Mortality Control

This herd is showing a long-term downward trend in buck and kid ratios. The population is increasing in spite of the decline in kid survival. These ratio data indicate that either the population is above range carrying capacity and/or habitat quantity and quality are declining.

Habitat Modification

Cooperative habitat modification projects to benefit pronghorn will be encouraged between the Department and federal land management agencies.

Law Enforcement

Illegal taking of pronghorn has apparently not been a major factor in this unit. While some poaching does occur, it has had no significant impact on this herd.

Communication of Information

News releases regarding annual surveys and the hunting program will be continued. This plan will be aired publicly at meetings within the planning area.

Review and Update

Newly collected data will be continually added to the computer model. This model will be used to test management strategies and to determine what actions are needed to meet herd objectives.

Major plan revisions will be made at five-year intervals, if necessary.

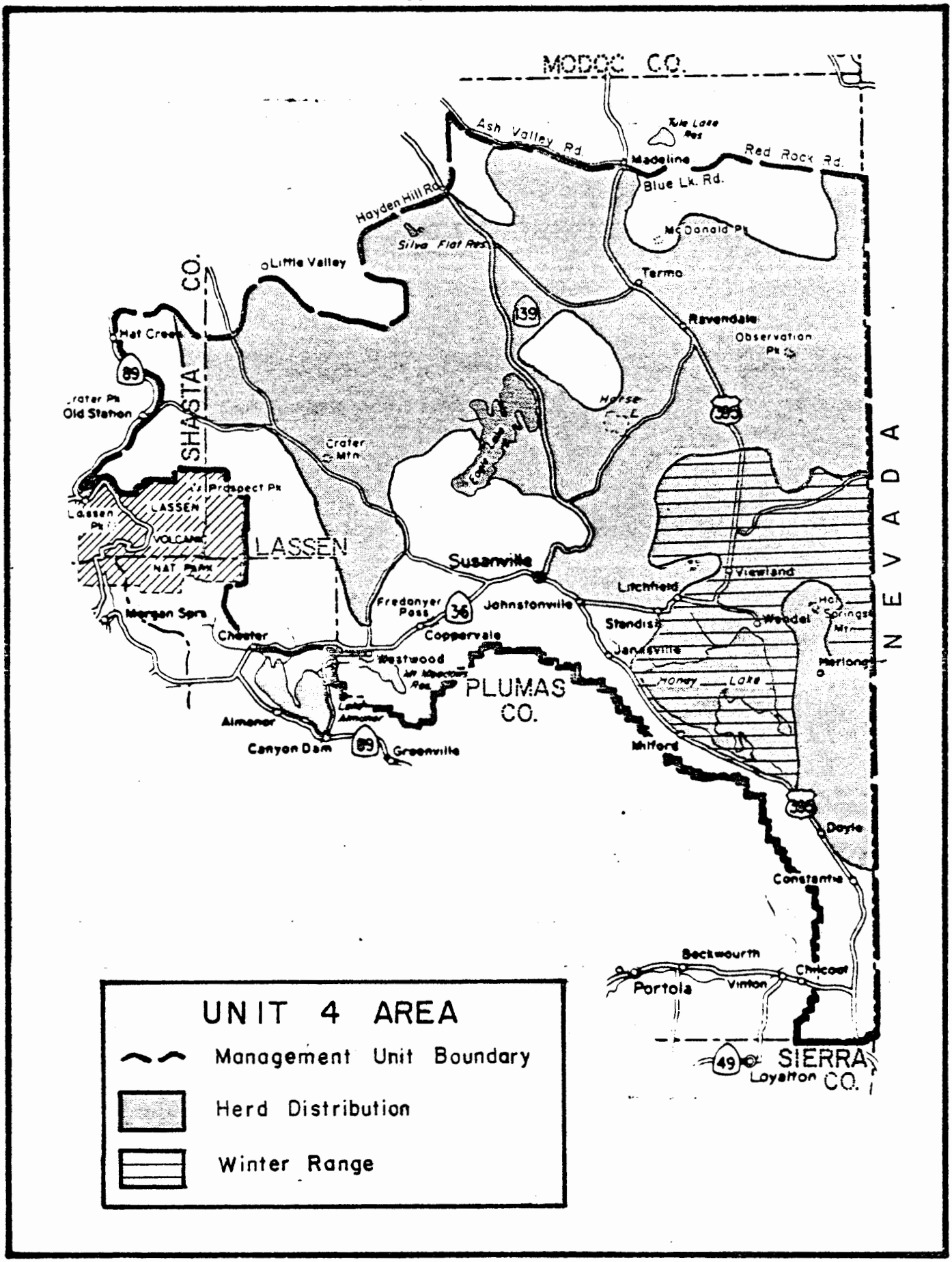
LASSEN HERD

Management Unit 4

Area Description (Figure 4-1)

Beginning at the junction of Highway 36 and the Juniper Lake road in the town of Chester; north along the Juniper Lake road to the Lassen National Park boundary; east, north, and west along the Lassen National Park boundary to Highway 89; then north along Highway 89 to U.S. Forest Service Road 22 near the Hat Creek Ranger Station; east along Road 22 to the State Game Refuge I-5 boundary; northwest along State Game Refuge I-5 boundary to the Coyote Canyon-Dixie Valley road; northwest along the Coyote Canyon-Dixie Valley road to the Dixie Valley-Boyd Hill Road; northwest along the Dixie Valley-Boyd Hill road to the Snag Hill-Hayden Hill road; northeast and north along the Snag Hill-Hayden Hill road to Highway 139; southeast on Highway 139 to the Willow Creek-Hunsinger Flat road; northeast and northwest along the Willow Creek-Hunsinger Flat road to the Adin-Madeline road; southeast along the Adin-Madeline road to Highway 395 at the town of Madeline; south along Highway 395 to the Madeline-Clarks Valley road; east along the Madeline-Clarks Valley road to the Clarks Valley-Tuledad road; east and southeast along the Clarks Valley-Tuledad road to the California-Nevada state line; south along the California-Nevada state line to the Lassen-Sierra County line; west along this line to the Lassen-Plumas County line; north and west along the Lassen-Plumas County line to Highway 36; west along Highway 36 to the Juniper Lake road.

FIGURE 4-1


MODOC CO.
Ash Valley Rd.
Tule Lake Res
Madeline
Red Rock Rd.
Blue Lk. Rd.
Hayden Hill Rd.
Silva Flat Res.
McDonald Pk
Little Valley
Termo
Ravendale
Observation Pt
139
Hat Creek
89
SHASTA CO.
Crater Pk
Old Station
Crater Mtn.
Horse L.
395
Prospect Pk
LASSEN VOLCANIC NAT PARK
LASSEN
Susanville
Litchfield
Viewland
Fredonyer Pass
36
Johnstonville
Standish
Wendel
Hot Springs Mtn
Morgan Spr.
Chester
Coppervale
Westwood
Janesville
Honey Lake
Merlong
PLUMAS CO.
Almanor
Canyon Dam
89
Greenville
Milford
395
Doyle
Constantia
Beckwourth
Portola
Vinton
Chilcoot
49
SIERRA CO.
Loyalton
NEVADA
UNIT 4 AREA
Management Unit Boundary
Herd Distribution
Winter Range

Land Ownership

This unit contains approximately 1,200,000 acres of range used by pronghorn. Approximate land ownership is as follows:

TABLE 4-1

Land Ownership-Unit 4
Range Area

Land Owner	Hectares	Acres	Percent
U.S. Bureau of Land Mgmt.	277,394	685,440	57
Private	175,605	433,920	36
U.S. Forest Service	32,635	80,640	7
	485,634	1,200,000	100

Land Uses

Livestock grazing, recreation, and timber production are major enterprises on public lands. The Honey Lake Wildlife Area, a Department of Fish and Game installation, raises cereal grain and aquatic plants for waterfowl and pheasants. Irrigated alfalfa and meadow hay are primary agricultural crops on private land.

Land use changes that will affect pronghorn are agricultural expansion into pronghorn summer and winter range areas and geothermal energy exploration and/or development. Undeveloped valley basin soils are being developed for alfalfa and grass hay production at Madeline Plains and Mud Flat. Numerous desert land entry applications on public domain, if approved, would result in significant additional agricultural expansion. Proposed geothermal energy development near Wendel, if developed, could adversely affect pronghorn winter range.

Vegetation, Soils, Water Availability

The pronghorn range in this unit is primarily sage-grassland. The western portion of the unit contains considerable timber stands. Large grass and sage-grass flats interspersed in these timber stands provide summer range for pronghorn. Junipers occur in limited areas and curl-leaf mahogany is fairly common at higher elevations. Agricultural land in the Honey Lake Valley and on Madeline Plains receives some use by pronghorn.

The Madeline Plains and Honey Lake Valley contain the largest areas of valley basin soils in old lake deposits. Several smaller areas of valley basin soils occur in this unit. A small area of metamorphic and granite soils occurs in southern Lassen County. The remainder of the area is composed of terrace and upland soils.

Precipitation ranges from 25.4 to 51 centimetres (10 to 20 inches), with the heaviest occurring in timbered areas in the western portion of the unit. Precipitation, primarily snow, occurs from October through April. Summer thundershowers occur sporadically, but are of little consequence to pronghorn forage.

Surface water is limited on some of the more arid portions of the range. Stock tanks, widely-spaced springs, and a few streams provide adequate pronghorn water, except during below normal precipitation years. During drought periods, many water sources dry up forcing wildlife to shift to better watered sites.

Habitat Status

Agricultural crops consist of alfalfa, meadow hay, irrigated pasture, and a small amount of cereal grain. Agricultural areas, except for Honey Lake

Valley, are minor habitats in this unit. Sage-grassland is the primary habitat type used by pronghorn. Bitterbrush, saltbush, rabbitbrush, mahogany, and juniper are brush species occurring in limited amounts in sage grass areas. Cheat-grass and annual forbs, such as sunflower, prickly lettuce, poverty weed plus numerous other varieties, are common in sage-grass areas. Perennial grasses are not abundant except in some upland areas. A dry land carex is a major habitat type on summer range in the western portion of the unit. Medusa head is invading several large areas of sage-grassland. Past overgrazing by livestock and fires have greatly reduced the variety of perennial forbs, which are very important pronghorn forage.

Population Trend

The Lassen herd increased from an average low from 1958 through 1963 of about 432 animals, to 1,428 in January, 1981 (Figure 4-2). This increase was not gradual but was in series of plateaus at about six-year intervals. Buck ratios have averaged below the northeastern California norm, and kid survival has been the lowest of any of the herds in the past 10 years (Figure 4-3). Reasons for these low ratios are not well known, however grazing pressure by wild horses and the permitted grazing use by cattle and sheep may be significant factors.

In the 1940s the Lassen population was the largest of any of the herds. A severe winter in 1951-52 resulted in the loss of over one-half of this population, including all of the group that wintered east of the Skedaddle Mountains. The population declined from an average of 3,000 in the 1940's to about 400 in 1954.

There is some interchange between animals from this herd and the Likely Tables and Big Valley herds. This interchange is subjectively clear from observations, but has not been quantified. There is also some interstate movement to and from Nevada.

FIGURE 4-2

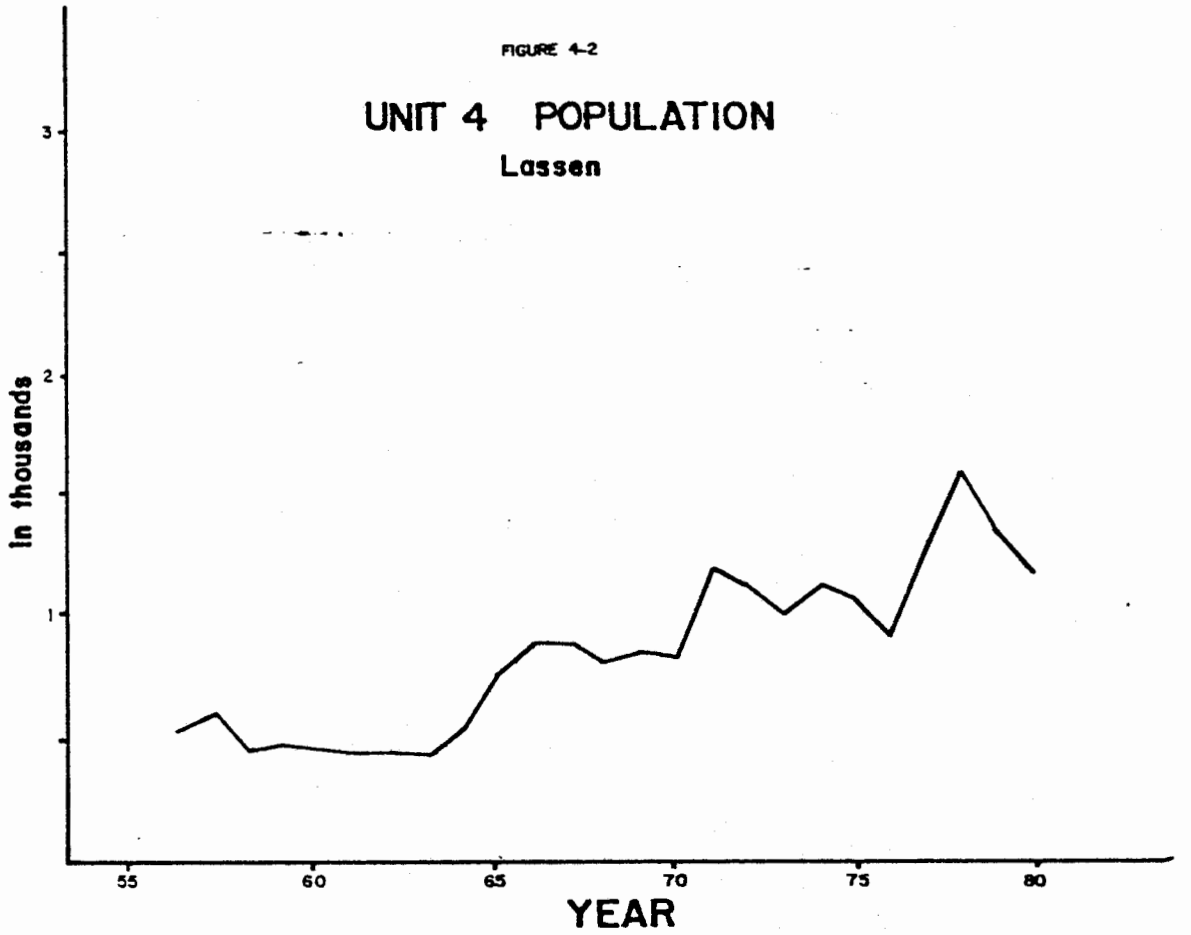
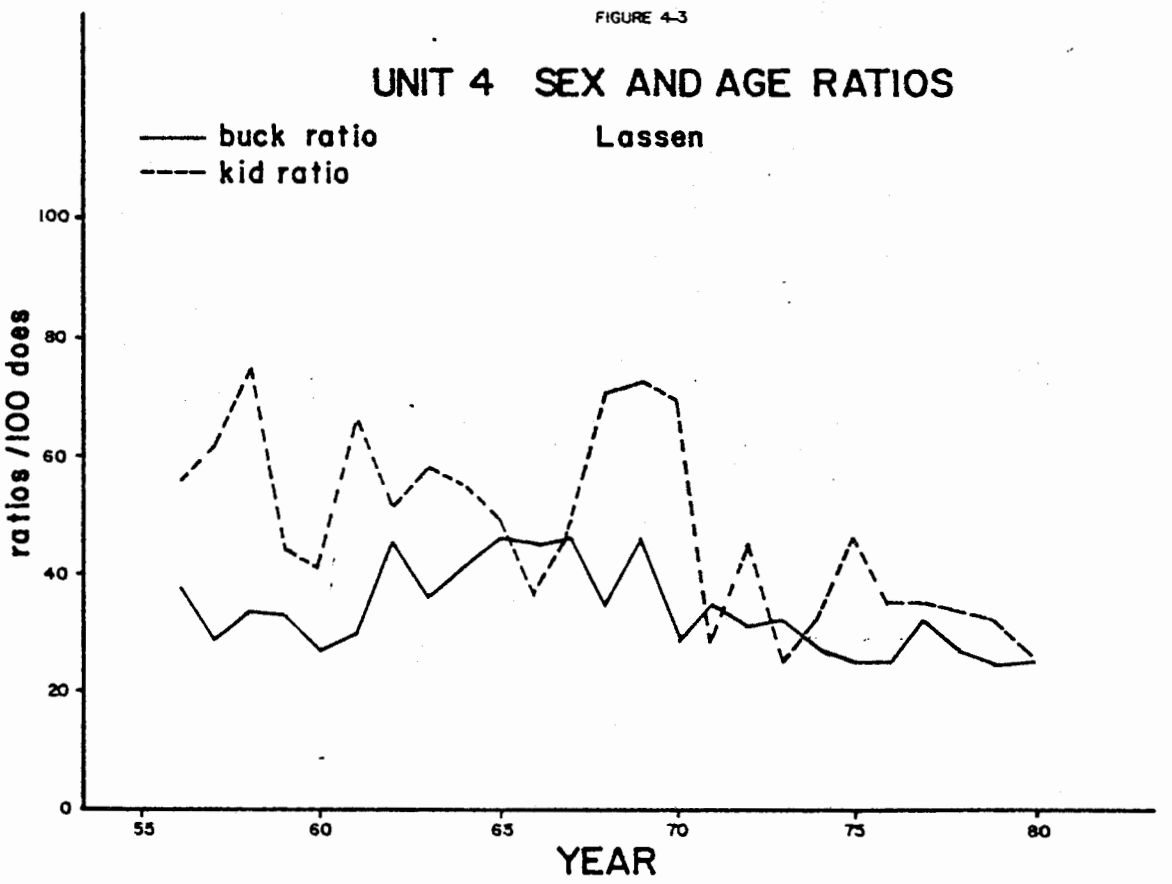


FIGURE 4-3



Depredation has not been a serious problem in this area. Although some pronghorn summer on private lands, landowners have not complained.

The Hayden Hill Game Refuge, for sage grouse and pronghorn, is located in this unit and summers approximately 200 pronghorn.

Range Extension

In the summer of 1980, small groups of pronghorn were observed near Chester and Westwood, significantly extending the range to the south and west. Around 1975 pronghorn were first noted in Spencer Basin in the Skedaddle Mountains. This movement was a permanent summer range extension. Pronghorn use has continued to the present and numbers have increased substantially.

An attempt to accelerate range extension in the former heavily populated pronghorn range on the east slopes of the Skedaddle Mountains was unsuccessful. This area formerly supported a wintering population of about 1,500 pronghorn, but these animals were lost during the severe winter of 1951-52. In 1978, 71 of the pronghorn trapped near Goose Lake, Modoc County, were released at the Skedaddle Ranch. The release site was in poor condition due to an extended drought and resultant lack of forage, which may have been the reason the animals rapidly dispersed. Most of the 71 pronghorns released migrated to the Honey Lake Valley. The release resulted in significant, though unintended, range extensions to the Milford and Hallelujah Junction areas of Lassen County. The Hallelujah population represents a range extension of about 72 kilometres (45 miles). These two extensions are represented by about 45 pronghorn, at least 32 at Milford, and 12 at Hallelujah Junction.

Migration Patterns

This herd migrates to and from seasonal ranges in excess of 113 kilometres (70 miles), the longest pronghorn migration known in California. For example, the travel route from Silva Flat summer range to Little Mud Flat winter range is at least 113 kilometres (70 miles). The route from Gray's Valley to Little Mud Flat is a minimum of 105 kilometres (65 miles).

There is an apparent movement of pronghorn between this herd and the adjoining Likely Tables herd. The Likely Tables area winters more animals than summer there. Indications are that this winter influx comes primarily from the Madeline Plains area of the Lassen herd's range, but this has yet to be positively determined. During some years, especially in 1980, there appeared to be a shift of animals from the Silva Flat area to the Big Valley herd range.

Migration corridors are critical to the welfare of pronghorn. These corridors must be kept free of obstruction so that pronghorn have free access to seasonal ranges.

Objectives

1. Restore and maintain the East Skedaddle/Eaglehead interstate wintering population to near the pre-1950 levels of about 1,000 animals (1945-50 average was 1,275).
2. Restore and maintain the herd wintering population at 2,500 pronghorn, including the East Skedaddle/Eaglehead group.
3. Maintain minimum herd ratio in August of 30 bucks and 50 fawns per 100 does.

Both buck and kid ratios have been well below the objective numbers, the buck ratio since 1971 and the kid ratio since 1970.

Management Strategies

1. Increase the population to 2,500 animals by:
   a. Improving habitat to provide better forage and thereby improving herd productivity. Perennial forb production should be emphasized to supply spring and early summer forage.
   b. Relocating animals from other herds to the eastern portion of the herd range.
   c. Controlling predators (coyotes) to determine if predation is depressing kid survival.

The BLM is currently preparing a grazing plan for its Cal-Neva unit. This draft plan calls for providing forage for 1,600 pronghorn in this unit. The plan also calls for livestock rest rotation grazing and some habitat manipulation to improve grazing. The Cal-Neva unit is that portion of the Lassen herd range lying east of Highway 395. The BLM is also developing a grazing plan for the Willow Creek unit, which adjoins the Cal-Neva unit's west boundary. These two plans should provide the necessary forage for pronghorn to meet the herd population objective.

Inventory and Investigation

Aerial census and herd composition surveys will be continued using the same techniques as in prior years. Aerial surveys will be conducted at three-year intervals to update and re-map kidding area location data.

The movement of a portion of the Lassen herd which summers on the Madeline Plains and winters on Likely Tables herd range, needs to be studied. In order to accomplish this, animals must be marked prior to fall migrations.

These animals can then be located during the subsequent winter census. Two summer range populations need to be studied: the northern Madeline Plains group and the animals in the Silva Flat area. The most feasible method to use would probably be the aerial marking system as used by Crump (Appendix 6).

Herd Management and Mortality Control

Coyotes will be intensively controlled in one large kidding area to determine if predation is a primary reason for the low kid ratios. Grasshopper Valley has been tentatively selected for this experiment. The following table shows kid ratios at Grasshopper Valley as compared to the ratio for the remainder of the herd.

TABLE 4-2

Comparative Kid Ratios-Unit 4

Kids Per 100 Does

YEAR	GRASSHOPPER	SAMPLE SIZE	REMAINDER OF LASSEN SUB-HERD	SAMPLE SIZE
1973	22 (-6)	170	28	691
1974	26 (-10)	131	36	723
1975	42 (-1)	75	43	758
1976	27 (-14)	151	41	660
1977	30 (-6)	127	36	789
1978	12 (-28)	150	40	794
1979	20 (-15)	161	35	877
1980	9 (-24)	197	33	1,086

( ) indicates difference between Grasshopper group and the remainder of Lassen pronghorn.

Habitat Modification

Primary emphasis will be to work with federal land management agencies to ensure that pronghorn are given adequate consideration in their land use planning efforts. Recommendations will be made regarding livestock management, fencing, forage allocations for wildlife, and water development and allocation plans. Cooperative programs to benefit pronghorn will be stressed. Control of medusa head will be encouraged.

Law Enforcement

Although some illegal kill may be occuring, the magnitude appears to be low. Based on computer analysis, once pronghorn reach the yearling age class, mortality from all causes, except legal hunting, is very low. Unless some evidence is found to indicate that poaching is a problem, no increase in the normal enforcement effort currently practiced is necessary.

Communication of Information

Current public communications consist of news releases regarding the results of census surveys, herd composition flights, and hunting season results. These efforts will be continued.

This management plan will be subject to public meetings to solicit public comment and recommendations prior to finalizing a management program.

Review and Update

The plan will be modified based on current data and herd objectives. The plan will be updated every five years if necessary.

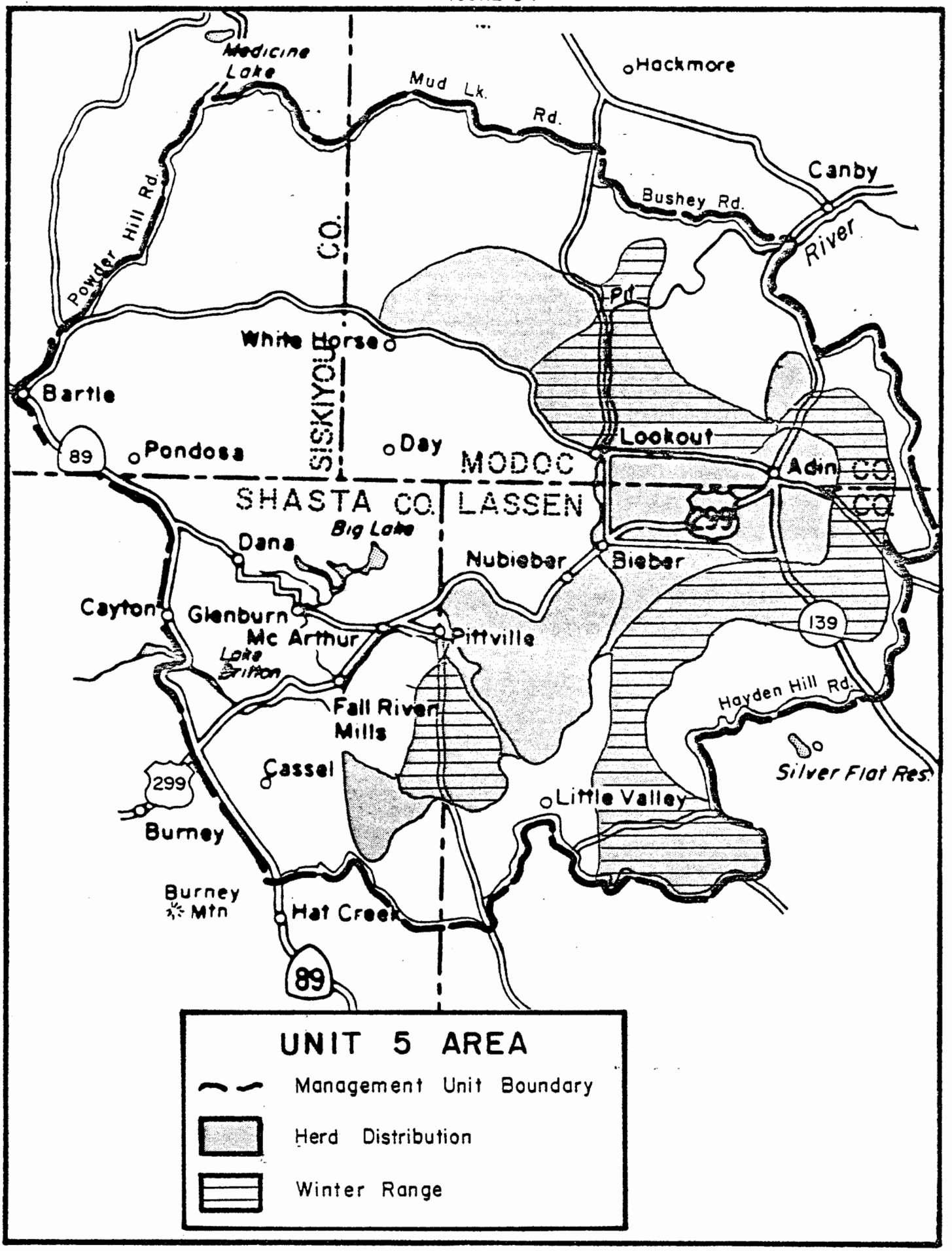
BIG VALLEY HERD

Management Unit 5

Area Description (Figure 5-1)

Beginning at the intersection of Highway 299 and Highway 89 northeast of Burney; north and northwest along Highway 89 to the Bartle-Telephone Flat road; northeast along the Bartle-Telephone Flat road to the Iodine Prairie-Long Bell road; southeast along the Iodine Prairie-Long Bell road to the North Main Road at Long Bell Forest Service Station; northeast along the North Main Road to the Mud Springs-Mud Lake road to Modoc County Road 91; south along Modoc County Road 91 to the Happy Camp-Cottonwood Flat road; southeast along the Happy Camp-Cottonwood Flat road to the Cottonwood Flat-Canby Bridge road; southeast along the Cottonwood Flat-Canby Bridge road to Highway 299; south along Highway 299 to the Hunters Ridge-Sweagert Flat road near Lower Rush Creek Recreation Site; east and south along the Hunters Ridge-Sweagert Flat road to the Sweagert Flat-Hunsinger Drow road; south and west along the Sweagert Flat-Hunsinger Draw road to the Adin-Madeline road; southeast along the Adin-Madeline road to the Hunsinger Flat-Willow Creek road; southeast and southwest along the Hunsinger Flat-Willow Creek road to Highway 139; northwest along Highway 139 to the Hayden Hill-Snag Hill road; south and southwest along the Hayden Hill-Snag Hill road to the Boyd Hill-Dixie Valley road; southeast along the Boyd Hill-Dixie Valley road to the Dixie Valley-Coyote Canyon road; southeast along the Dixie Valley-Coyote Canyon road to the State Game Refuge I-5 boundary; southeast along the State Game Refuge I-5 boundary to U.S. Forest Service road 22; then west on Road 22 to Highway 89 near the Hat Creek Ranger Station; north along Highway 89 to the intersection at Highway 299.

FIGURE 5-1


Medicine Lake
Mud Lk. Rd.
Hackmore
Canby
Bushey Rd.
Powder Hill Rd.
CO.
River
Pit
White Horse
SISKIYOU
Bartle
Lookout
89
Pondosa
Day
MODOC
Adin CO.
SHASTA CO.
LASSEN CO.
299
Big Lake
Dana
Nubieber
Bieber
Cayton
Glenburn
Mc Arthur
Pittville
139
Lake Britton
Hayden Hill Rd.
Fall River Mills
Silver Flat Res.
Cassel
299
Little Valley
Burney
Burney Mtn
Hat Creek
89
UNIT 5 AREA
Management Unit Boundary
Herd Distribution
Winter Range

Land Ownership

Approximately 310,000 acres of the unit is pronghorn range. Unlike other herd areas which are predominately public lands, about 66 percent of this area is private land. Approximate land ownership is as follows:

TABLE 5-1

Land Ownership-Unit 5
Range Area

Land Owner	Hectares	Acres	Percent
Private	82,962	205,000	66
U.S. Forest Service	18,211	45,000	14
U.S. Bureau of Land Mgmt.	24,282	60,000	20
	125,455	310,000	100

Land Uses

Timber production, livestock grazing, and recreation are primary uses of public lands. Alfalfa hay production is the major agricultural crop and some cereal grain and irrigated pasture is also grown. Most of the hay produced is used locally for winter livestock feed. Some recreational subdivision activity is beginning to occur.

Vegetation, Soils and Water Availability

Pronghorn winter range in Unit 5 is centered in the Big Valley and Dixie Valley areas. Fox Mountain, the southern and eastern areas of Big Valley, and the north side of Dixie Valley are primarily wintering areas. Some pronghorn disperse from these wintering area to summer ranges at Egg Lake, Round Valley, Bald Mountain, and into agricultural lands in Big Valley. Winter habitats are primarily sage-grassland with interspersed juniper in some area. Summer range includes agricultural, meadow, and sage-grass range. The unit contains significant timber stands which are lightly used by pronghorn.

Big Valley, Round Valley, Dixie Valley, and Whitehorse Flat are lake deposits containing valley basin soils. The remainder of the area is primarily terrace and upland soils.

Precipitation ranges from 51 to 76 centimetres (20 to 30 inches). Snow is the primary precipitation, and most rain and snow occur from October through April.

Stockponds, streams, reservoirs, springs, and vernal lakes supply adequate water for pronghorn. Extended droughts can result in some water deficient areas. Agricultural areas are well watered.

Most higher elevation and high precipitation areas are timberland. Yellow pine and white fir are predominant timber types. The remainder of the unit is sage grassland with some curlleaf mahogany at the more arid high elevation sites, and some juniper in sage-grassland areas. Various sage species, cheatgrass, and medusa head are dominant sage-grass area plants. Annual forbs are also abundant in these areas.

Habitat Status

Land-use changes that are affecting pronghorn are agricultural expansion, primarily of irrigated alfalfa and recreational subdivisions.

The most serious threat to pronghorn in this area is rural residential development. This effort has been very limited to date, but the threat is eminent.

Wildfires burned over 120,000 acres of timber and brush land in this herd unit in 1978. Pronghorn extended their summer range into these burns in 1979. Burns such as this provide excellent summer pronghorn forage for a few years after the burn.

Medusa head is encroaching onto much of the pronghorn range on Fox Mountain, Muck Valley, and in the Dixie Valley area. This change is suspected as being detrimental to pronghorn; but corroborating data are needed.

Population Trend

The Big Valley pronghorn population reached the most recent low point of 177 in 1968. Since 1968, the population had increased to about 600 animals by 1979 (Figure 5-2). The 1980 census counted 1,291 pronghorn, but some of these were probably Lassen herd animals since more than doubling the population was impossible with the 1977 kid ratio of 44 per 100 does (Figure 5-3). In addition the Lassen population showed an apparent decline. Kid production has sustained better in this herd than in most others.

Some of this population is migratory, moving to and from Shasta County and from Dixie Valley to Big Valley. The Fox Mountain population is less migratory with some animals summering in the Egg Lake area.

Depredation to alfalfa is becoming more serious each year. Two landowners lodged vigorous complaints in 1979. Twenty doe pronghorn permits were approved for a new sub-zone 6a during the 1980 special hunt as a result of these two complaints.

Those animals in the Big Valley agricultural area totaled 622 in January, 1981. The animals found in Dixie Valley (488) and in Shasta County (68) are not significantly involved in agricultural depredation. The Dixie Valley group counted there in January, 1981, is probably animals that normally winter in the Lassen herd area. Due to the mild open winter in 1981, this group may have moved down into Dixie Valley rather than to their normal winter range, which is thought to be in the Mud Flat area.

FIGURE 5-2

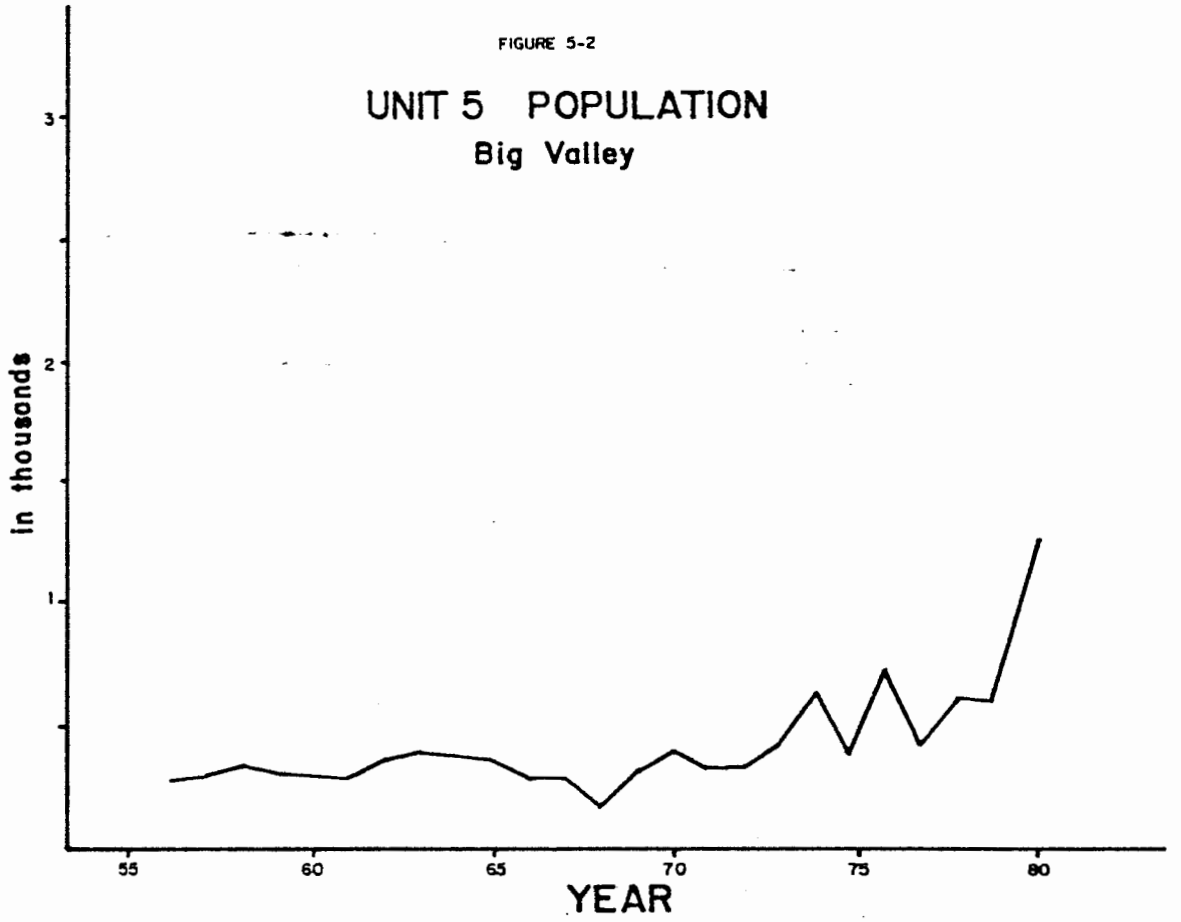
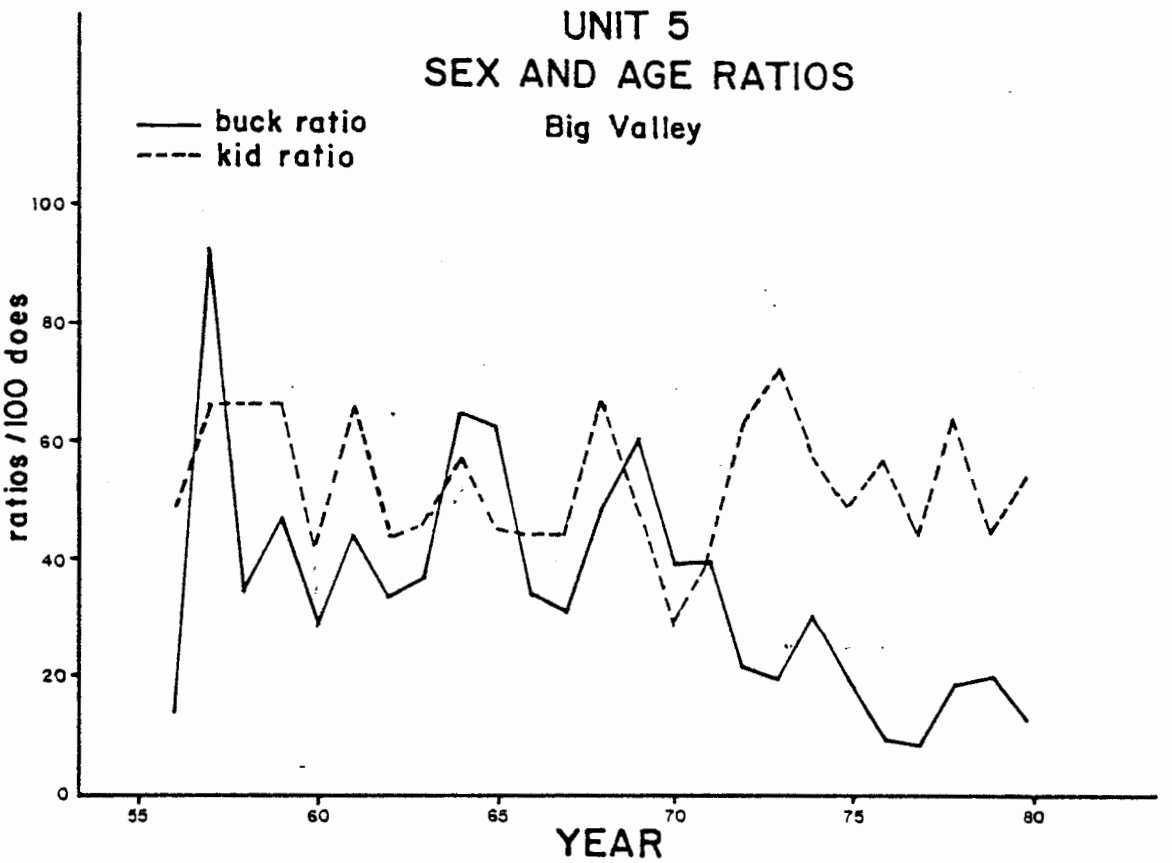


FIGURE 5-3



Objectives

1. Manage the population at 450 in crop damage areas, and 250 in other areas.
2. Maintain herd ratios at the time of the summer herd composition survey of at least 35 bucks and 55 kids per 100 does.

A population of 700 animals will reduce depredation and allow for some increase in animal numbers in areas where crop depredation is not occurring. Based on 1981 census data, this objective would require removal of 177 animals including females.

Management Strategies

The herd ratio objectives are reachable and maintainable through public hunts, including either sex harvests.

Inventory and Investigation

Aerial herd composition and census surveys will be continued. Periodic aerial surveys to locate and map kidding grounds will continue to be conducted at three-year intervals.

Census data indicates that there is an exchange of animals between this herd and the Lassen herd which occurred in 1980. The magnitude of this movement needs to be determined in order to reach herd objectives.

County, state, and federal land use plans, zoning, and habitat manipulation proposals will be monitored and analyzed on the basis of their anticipated effects on pronghorn.

Data will be stored by computer, analyzed, and management strategies will be adapted to meet herd objectives based on the model.

Herd Management and Mortality Control

1. Control the population at 450 animals in the Big Valley agricultural areas and 250 in other areas of the herd range by: (a) Hunter harvest during regularly scheduled seasons, and/or by (b) trapping and relocating (if suitable sites are available), and/or by (c) special hunt if necessary.

Hunting will be the primary means of maintaining this population at the desired management level. The number of permits for each sex will be based on herd ratio objectives. If a need arises to reestablish populations elsewhere in California or the western states, animals in excess of the herd size objectives may be trapped and relocated.

Habitat Modification

No habitat manipulation projects specifically to benefit pronghorn are planned. Experimental control of medusa head should be tested to determine its effects on pronghorn.

Law Enforcement

Illegal take of pronghorn apparently poses no problems to the herd. No additional patrol efforts are necessary at this time.

Communication of Information

The current news release system of reporting results of surveys and the hunting program will be continued. This plan will be aired with the public for comments.

Review and Update

Annual data will be added to the herd computer model program. The model will be used to evaluate how well planning objectives are being met.

Major plan revisions will be made at five-year intervals if necessary.

SURPRISE VALLEY HERD

Management Unit 6

Area Description (Figure 6-1)

Beginning at the crest of the Warner Mountains on the California-Oregon state line; east along the California-Oregon state line to the California-Nevada state line; south along the California-Nevada state line to the Tuledad-Clarks Valley road; west and northwest along the Tuledad-Clarks Valley road to the Clarks Valley-Long Valley road; north along the Clarks Valley-Long Valley Road to the South Warner road; east along the South Warner road to the Summit Trail near Patterson Guard Station; north along the Summit Trail to the crest of the Warner Mountains at Pepperdine Camp; north along the crest of the Warner Mountains to the California-Oregon state line.

Land Ownership

Approximate distribution of land ownership of the unit used by pronghorn follows:

TABLE 6-1

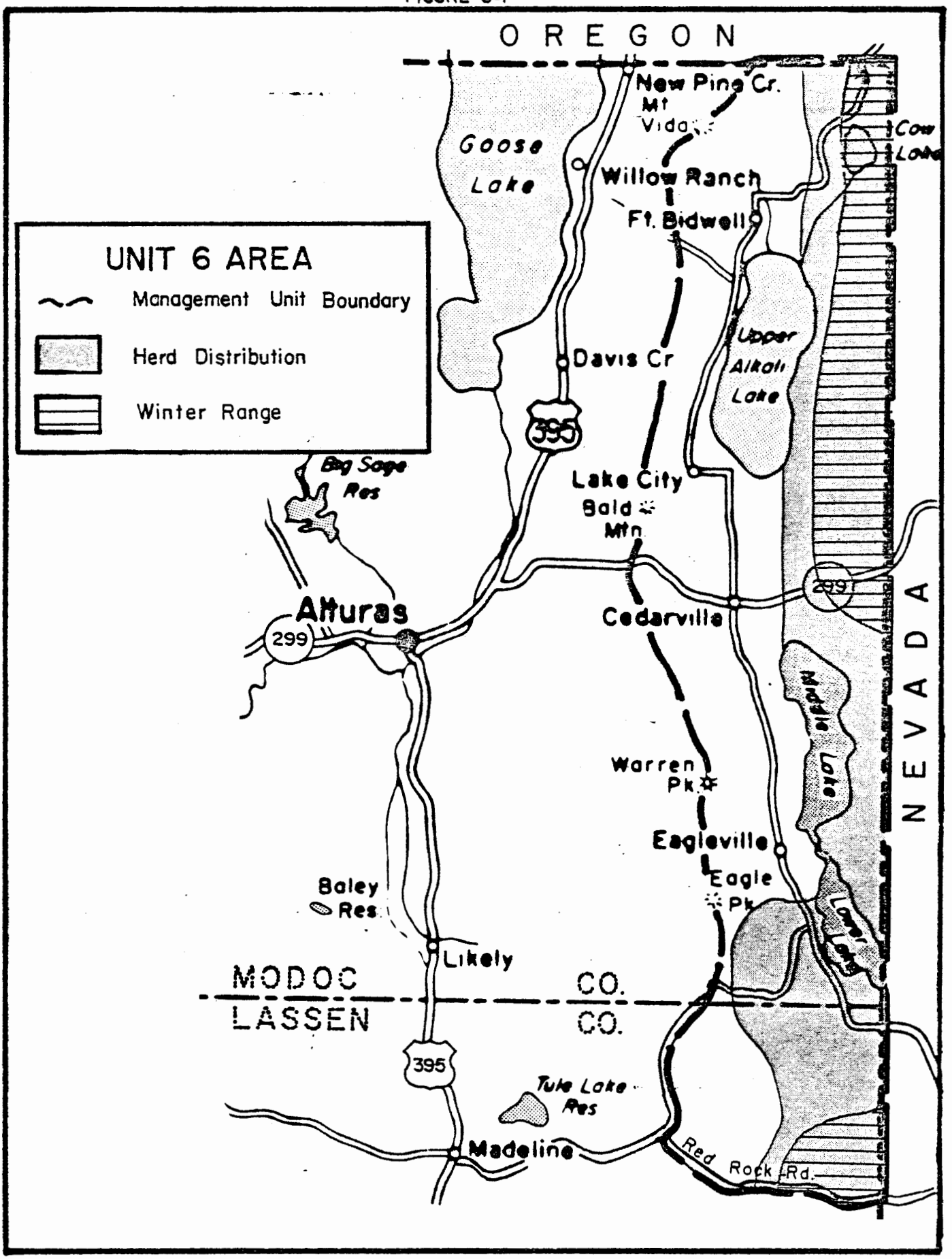
Land Ownership-Unit 6 Range Area

Ownership	Hectares	Acreage	Percent
U.S. Bureau of Land Mgmt.	39,458	97,500	85
Private	6,667	16,500	14
U.S. Forest Service	405	1,000	1
	46,540	115,000	100

Land Uses

Livestock grazing and recreation are primary uses of public lands used by pronghorn. Livestock grazing and hay production are the primary uses of the private lands involved.

FIGURE 6-1


OREGON
New Pine Cr.
Mt Vida
Goose Lake
Willow Ranch
Ft. Bidwell
Cow Lake
UNIT 6 AREA
Management Unit Boundary
Herd Distribution
Winter Range
Upper Alkali Lake
Davis Cr
395
Big Sage Res
Lake City
Bald Mtn
Alturas
299
Cedarville
Warren Pk
Eagleville
Eagle Pk
Baley Res
Likely
MODOC CO.
LASSEN CO.
Tule Lake Res
Madeline
Red Rock Rd.
NEVADA

Vegetation, Soils, and Water Availability

Pronghorn in this unit primarily use sage-grass range. Some pronghorn use of agricultural lands occurs at Cowhead Lake. Pronghorn do not use agricultural lands west of the alkali lakes in Surprise Valley and they do not normally occur in the Warner Mountains.

Surprise Valley and Cowhead Lake are composed of valley basin soils from old lake deposits. The remainder of the pronghorn range in this unit is terrace and upland soils.

Precipitation ranges from 20 to 51 centimetres (8 to 20 inches). The Warner Mountains receive the heaviest precipitation, most of which occurs as snow during winter months.

Most of the pronghorn range is adequately watered. There is some sandy area east of the alkali lakes which is water deficient and is only lightly used by pronghorn.

Agriculture consists primarily of irrigated alfalfa, some meadow hay and cereal grains. Timber, primarily white fir and ponderosa pine, occurs on the Warner Mountains outside of pronghorn use areas. The remainder of the area is sage-grassland with interspersions of bitterbrush, juniper, mahogany, and a desert shrub complex east of the alkali lakes. Desert shrub areas are primarily black greasewood/saltbush/horse brush type with some great basin rye.

Habitat Status

Changes in land use have been limited to the expansion of irrigated alfalfa into pronghorn range. Geothermal steam exploration has been done in the

Cowhead Lake area, but there has been no development of this steam resource. Such developments could adversely affect pronghorn.

Recreational subdivision activity has not yet occurred in this unit.

Population Trend

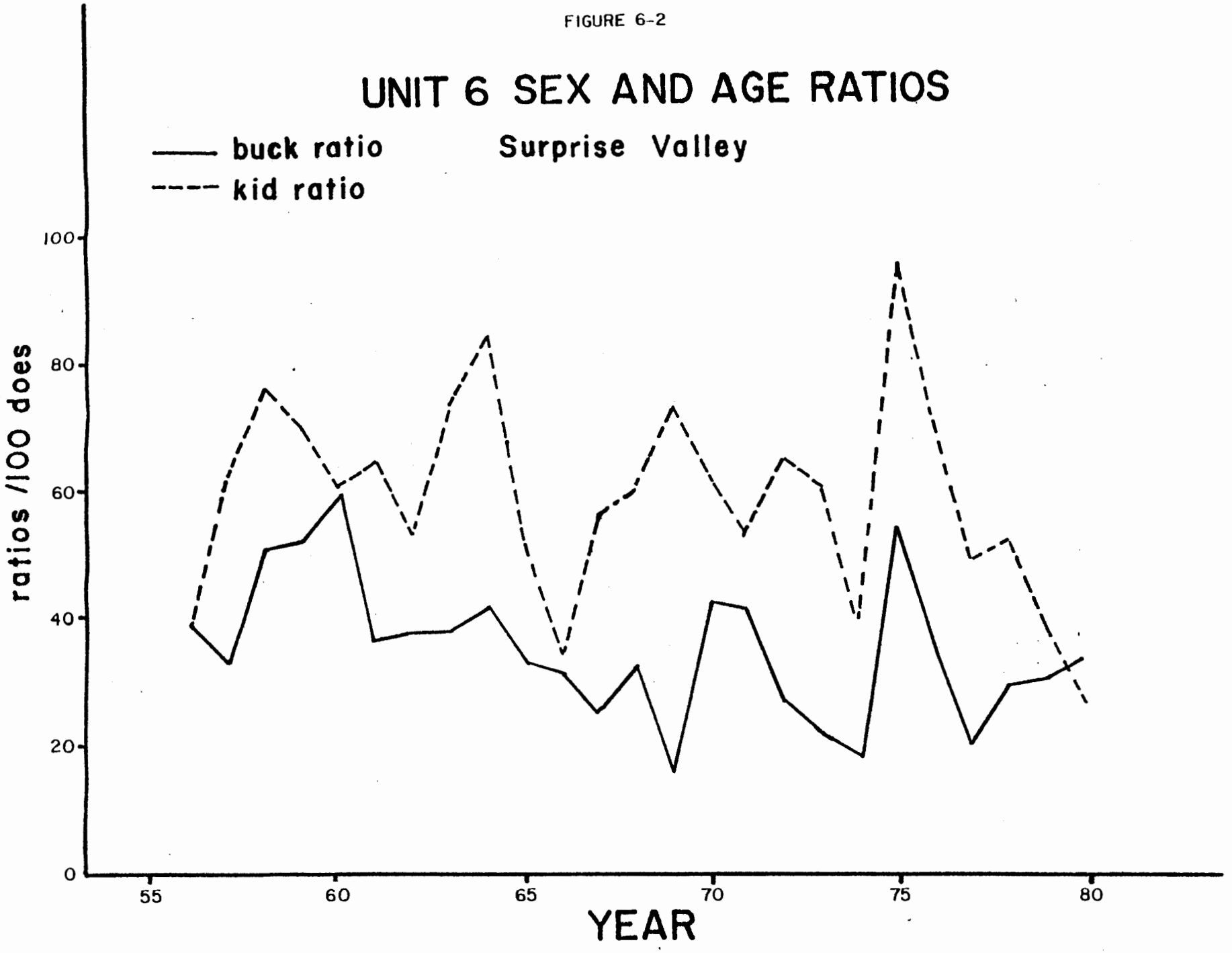
Based on sample sizes of summer herd composition surveys, the Surprise Valley herd has about doubled in size since 1956. The most recent five-year average, 200 animals, is conservative, since some pronghorn use-areas are not surveyed. The Coppersmith Hills, Wire Lake, and Tuledad Canyon area all contain summering populations, but are not checked during herd composition surveys. The kid ratio has averaged 55 to 100 does over the past 10 years, ranging from a high of 96 in 1976, to the all-time low of 27 in 1980 (Figure 6-2). Prior to the recent series of hunts initiated in 1964, buck ratios averaged over 40 per 100 does. The reason for the declining trend in kid ratios the past two years is not known.

Pronghorn from this unit normally winter in Nevada. As a result, in 23 years of the winter census attempts in this unit, pronghorn have been found during only ten surveys.

Buck harvest has averaged 11 for the past 13 years. In 1980, an archery only season was held in this unit. In 1980, 25 archers took one buck. Buck harvest has been static.

Efforts to determine population trends have been limited to annual herd composition surveys and, until 1979, a winter census. Kidding grounds have been located and mapped, and this information is updated periodically by aerial survey.

FIGURE 6-2


UNIT 6 SEX AND AGE RATIOS
buck ratio
kid ratio
Surprise Valley
ratios /100 does
100
80
60
40
20
0
55
60
65
70
75
80
YEAR

Pronghorn use crop land at Cowhead Lake for forage. Although some depredation is occurring there, no complaints have been received.

Objectives

1. Manage the summering population at 400 animals.
2. Maintain herd ratios of 35 bucks and 55 kids per 100 does.

The population objective will require an increase of an estimated 50 percent in the summering population. The kid ratio objective is equal to the ten-year average. Herd ratio goals are achievable and the population goal can be achieved if these are maintained.

Management Strategies

Increase the population by 50 percent by working with the Bureau of Land Management and the Nevada Department of Wildlife to insure that pronghorn are given adequate consideration in forage allocations. The Bureau of Land Management's Tuledad/Home Camp and Cowhead/Massacre (draft) grazing environmental statements allow sufficient forage for pronghorn to reach the population objective. These plans, when implemented, should result in increased kid survival, and an increased population.

Once the population objective is reached, a system of population control will have to be developed and implemented jointly with the Nevada Department of Wildlife.

Inventory and Investigation

The present annual aerial herd composition survey will be continued and expanded to cover all pronghorn use areas in the unit resulting in a summer

population census. This census is necessary to determine how the present population compares with the population objective.

Kidding ground data will be updated periodically by aerial surveys.

Herd Management and Mortality Control

Hunting will be the primary means of maintaining the population at the desired management level. The number of permits for each sex will be based on herd ratio objectives.

Habitat Modification

The BLM plans extensive range modification projects on grazing districts used by this herd. No projects specifically for pronghorn are proposed.

Law Enforcement

There are no current reports of significant pronghorn losses due to illegal hunting activities; therefore, no changes in present enforcement is needed.

Communication of Information

The news release system to provide public information on the results of herd composition surveys and the hunting proposals, will be continued. The plan will be aired publicly to elicit comments.

Review and Update

No computer model has been developed for this herd due to a lack of census data. A model will be prepared using summer census information. Current data will be inserted into this model to determine if changes in management strategy are necessary, and to evaluate herd conditions and trend. Major plan revisions will be made at five-year intervals if necessary.

MONO HERD

Management Unit 7

Area Description (Figure 7-1)

Beginning at the junction of Highway 395 and the California-Nevada state line; southeast along the California-Nevada state line to the Inyo National Forest boundary about .7 miles southeast of Highway 6; south and east along the Inyo National Forest boundary to the Mono-Inyo county line; west along the Mono-Inyo county line to Highway 395; north and west along Highway 395 to the point of beginning.

Land Ownership

One herd and a recently introduced herd are within this unit. The Bodie Hills area near Bridgeport, California, is about 70 percent BLM land and 30 percent land administered by the Toyabe National Forest. Pronghorn summer in this area and move into Nevada to winter, where the range is largely administered by the BLM.

Adobe Valley was the site of an introduction of 40 pronghorn in March, 1982. This area is largely administered by the BLM and is 90 percent public. The remainder is private land (Figure 7-1).

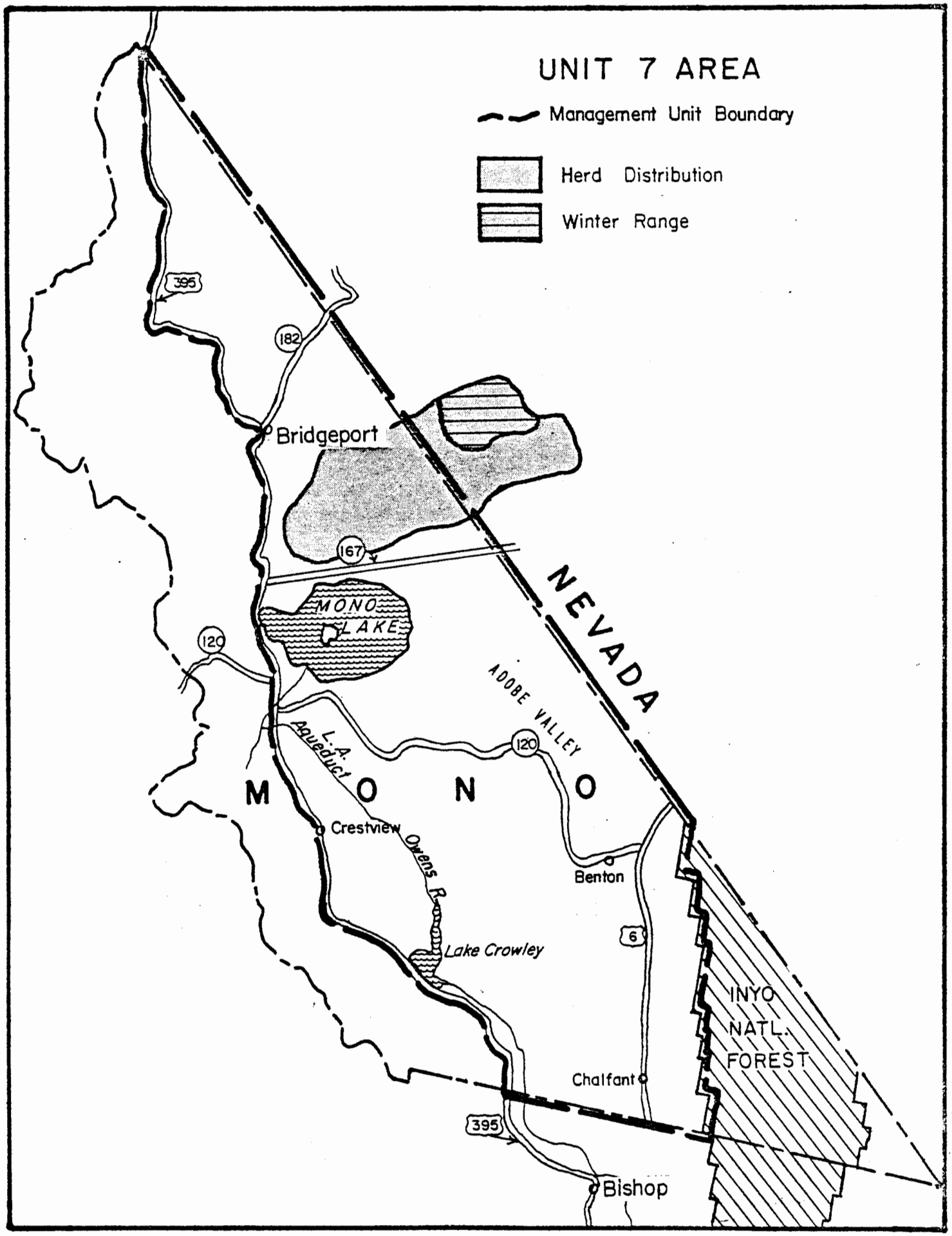
Land Uses

Livestock grazing is the primary use of the pronghorn range in Mono County. Recreational use is increasing in the Bodie Hills with the addition of new roads. The number of leases for geothermal projects is increasing there, as is the interest in mineral resources of the area.

Vegetation and Water Availability

In the Bodie Hills the vegetative community is classified by CALVEG as pinyon - juniper with many areas of sagebrush, bitterbrush, and perennial grasses.

FIGURE 7-1


UNIT 7 AREA
Management Unit Boundary
Herd Distribution
Winter Range
395
182
Bridgeport
167
MONO LAKE
120
NEVADA
ADOBE VALLEY
L.A. Aqueduct
120
M O N O
Crestview
Owens R.
Benton
6
Lake Crowley
INYO NATL. FOREST
Chalfant
395
Bishop

There are several types of water sources such as lakes, streams, water troughs, pipe lines, windmills, and irrigation ditches. Water shortages are seldom a problem.

The BLM identifies three major vegetation series comprising Adobe Valley. These are Indian ricegrass, big sagebrush, and saltgrass/meadow (Capodice 1982). Sources of water include springs, lakes, streams, reservoirs and wells. Including livestock water troughs, about one water source exists per two square miles (Capodice 1982).

Habitat Status

There are about 148,000 hectares (366,000 acres) of habitat suitable for pronghorn in Mono County, however range conditions are poor and soil erosion is increasing. The Bodie Hills are estimated to have the highest rated habitat suitability (high-fair) for pronghorn in Mono County, and Adobe Valley has the next highest suitability, rated as low-fair (Capodice 1982).

BLM surveys indicate that most livestock grazing allotments are over-stocked, resulting in pronghorn being excluded from small meadows by cattle and sheep. Geothermal and mining exploration and development are expected to cause further plant and soil disturbance.

Population Trend

The Bodie herd has been estimated at about 100 for the last ten years and the number is expected to remain static. (Tables 7-1 through 7-3.)

A pronghorn hunting season has been held in Nevada from 1961 to the present, excluding 1965 and 1966. The harvest has remained at about 5 per year (Table 7-4).

The pronghorn released in Adobe Valley are being followed visually and by radio telemetry to determine their survival rate and distribution.

Table 7-1

SUMMER PRODUCTION AND HERD COMPOSITION - UNIT 7

	Year:	1961	1962	1963	1964	1965	Average
Number Classified	Total Classified		21			35	
	Bucks		7			11	
	Does		12			17	
	Kids		2			7	
Ratio	Bucks/100 Does		58			65	
	Kids/100 Does		17			40	
	Kids/100 Adults		10			5	

	Year:	1966	1967	1968	1969	1970	Average
Number Classified	Total Classified				46	56	
	Bucks				7	6	
	Does				31	26	
	Kids				8	13	
Ratio	Bucks/100 Does				23	23	
	Kids/100 Does				26	50	
	Kids/100 Adults				21	40	

From: Nevada Department of Wildlife, Form 321, Management Area 20.

Table 7-1 (Continued)

SUMMER PRODUCTION AND HERD COMPOSITION - UNIT 7

	Year:	1971	1972	1973	1974	1975	Average
Number Classified	Total Classified	34		43	42	66	
	Bucks	6		2	4	15	
	Does	25		32	28	40	
	Kids	3		9	10	11	
Ratio	Bucks/100 Does	24		6	14	38	
	Kids/100 Does	12		28	36	28	
	Kids/100 Adults	10		26	31	20	

	Year:	1976	1977	1978	1979	1980	1981
Number Classified	Total Classified	61	51	63	68	34	77
	Bucks	3	9(3mat)		7	4	8
	Does	43	35	46	46	22	55
	Kids	18	7	14	15	8	14
Ratio	Bucks/100 Does		26		15	18	15
	Kids/100 Does	42/100	20	30	33	36	25
	Kids/100 Adults	39/100	16		28	31	22

From: Nevada Department of Wildlife, Form 321, Management Area 20.

Table 7-2

ANNUAL SPRING CENSUS - UNIT 7

Year:	1961	1962	1963	1964	1965	Average
No. Counted	21	27	49	35	35	33
No. Classified	21	27	49	35	35	33
Bucks	9	9	8	3	3	6.4
Does	12	18	41	32	32	27
Buck/Doe Ratio	43/100	50/100	20/100	9/100	9/100	26/100

Remarks:

Year:	1966	1967	1968	1969	1970	Average
No. Counted	49	40		65	34	
No. Classified	49	40		65	34	
Bucks	14	15			6	
Does	35	25			28	
Buck/Doe Ratio	40/100	60/100			22/100	

Remarks:

From: Nevada Department of Wildlife, Form 321, Management Area 20.

Table 7-2 (cont.)

ANNUAL SPRING CENSUS - UNIT 7

Year:	1971	1972	1973	1974	1975	Average
No. Counted	79	50	51	84	42	
No. Classified		50	51	84	42	
Bucks		14	13	19	9	
Does		36	38	65	33	
Buck/Doe Ratio		39/100	34/100	29/100	27/100	

Remarks:

Year:	1976	1977	1978	1979	1980	1981
No. Counted	39	92	64	107	59	84
No. Classified	39	92	64	107	59	84
Bucks	2	14	15	28	15	14
Does	37	37	49	67	44	70
Buck/Doe Ratio	5/100	18/100	30/100	41/100	34/100	20/100

Remarks:

From: Nevada Department of Wildlife, Form 321, Management Area 20.

TABLE 7-3

NEVADA SEASONS - BODIE HERD

Year	Season Dates	Quota	Harvest	Success (%)
1961	8/26-9/4	20	6	30
1962	8/25-9/3	20 (19)	5	26
1963	8/24-9/2	10	6	60
1964	8/29-9/7	10	1	10
1965	closed			
1966	closed			
1967	8/26-9/2	10	4	40
1968	8/24-9/2	10	5	50
1969	8/23-9/1	10	4	40
1970	8/24-9/2	10	7	70
1971	8/29-9/7	10	3	30
1972	8/26-9/4	10	4	40
1973	8/25-9/16	10	6	60
1974	8/24-9/2	10	6	60
1975	8/23-9/1	10	7	70
1976	8/21-8/29	5	3	60
1977	8/27-9/5	10	5	50
1978	closed			
1979	8/26-9/4	10	6	60
1980	8/23-9/1	10	4	40
1981	8/22-8/30	10		

From: Nevada Department of Wildlife, Form 321, Management Area 20.

Objectives

The Nevada Department of Wildlife, BLM, and DFG personnel have agreed upon 200 animals as the population objective for the Bodie herd. This number also is planned for the Adobe Valley area.

Concurrent with the Adobe Valley introduction, two objectives have been outlined. One objective is the modification of water developments and fences to better suit pronghorn. Secondly, habitat will be enhanced to meet pronghorn requirements (Capodice 1982).

Management Strategies

Protect the soils and plants of the Bodie Hills area to preserve pronghorn forage.

Reduce livestock AUM allotments in the Bodie Hills as indicated in BLM surveys and increase AUM's for pronghorn. About 162 AUM's are required by 200 pronghorn on the Bodie Hills summer range, 84 AUM's on the Powell Mountain summer range, and 240 AUM's on the winter range (Nevada Department of Fish and Wildlife Project W-48-8, 1978). Impacts of mining operations and geothermal developments in this area need to be minimized.

Continue the limited buck hunts in Nevada and coordinate with the Nevada Department of Wildlife to take a limited number of bucks in California.

In Adobe Valley, delay grazing seasons in some pastures to make more pronghorn forage available.

Design livestock fences to allow access and seasonal movement of pronghorn and protect meadows from over-use by livestock. No campgrounds be established along Adobe Creek and restrict vehicular use to existing roads and trails.

Allow no surface occupancy of energy development sites within kidding and important forb production areas.

Maintain wild horse AUM's at or below the present level of 98.

Maintain a no-let-burn policy for wildfires within the transplant area. Time prescibed fires in Adobe Valley to increase forbs and grasses, normally in late fall.

Inventory and Investigation

Continue to obtain composition counts and harvest information from Nevada Department of Wildlife for the Bodie herd.

In Adobe Valley, make composition counts twice each year. Conduct aerial censuses if the population becomes established. Evaluate pronghorn forage production and determine whether management objectives are being met.

Herd Management and Mortality Control

Eight of the 40 pronghorn released in Adobe Valley were radio collared and all are being monitored visually to determine causes of mortality and distribution, emphasizing kidding areas.

Habitat Modification

No habitat modification is planned for the Bodie Hills area.

In Adobe Valley, several water developments will be improved to better provide for pronghorn. Spring sources will be fenced to exclude wild horses and cattle but allow pronghorn use. Water will be piped outside the enclosure for horse and cattle use. Livestock grazing will be timed to encourage important forbs for pronghorn.

Vegetation will be manipulated in shrub communities to promote preferred forage. Dense sagebrush along Adobe Creek will be removed in several areas to provide access for pronghorn to water (Capodice 1982).

Law Enforcement

An increase in poaching is foreseen in the Bodie Hills with the addition of new roads. The extent of potential poaching in Adobe Valley is unknown.

Communication of Information

News releases regarding the herds will be continued. This management plan will be publicly aired for comments.

Review and Update

Herd data will be reviewed and an assessment made annually of the unit's status. Major plan revisions will be made at 5-year intervals if necessary.

Some of the animals transplanted to Adobe Valley are not remaining in that area, but they will be managed where they establish and the plan will be modified accordingly.

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APPENDIX 1

PLANTS WITHIN PRONGHORN RANGE

(A Partial Plant List)

TREES

White Fir	Abies concolor
Red Fir	Abies magnifica
Ponderosa Pine	Pinus ponderosa
Sugar Pine	Pinus lambertiana
Lodgepole Pine	Pinus contorta
Incense Cedar	Libocedrus decurrens
Jeffrey Pine	Pinus jeffreyi
Juniper	Juniperus occidentalis
Black Oak	Quercus kelloggii
Aspen	Populus tremuloides
Cottonwood	Populus trichocarpa

Shrubs

Alder	Alnus tenuifolia
Bitterbrush	Purshia tridentata
Snowbrush	Ceanothus velutinus
Buckbrush	Ceanothus cuneatus
Deerbrush	Ceanothus intergerrimus
Whitethorn	Ceanothus cordulatus
Squaw apple	Peraphyllem ramisossimum
Snowberry	Symphoricarpos rotundifolius
Bitter Cherry	Prunus emarginata
Chokecherry	Prunus virginiana
Sierra Plum	Prunus subcordata
Serviceberry	Amelanchier alnifolia
Rabbit Brush	Chrysothamnus spp.
Big Sagebrush	Artemesia tridentata
Black Sagebrush	Artemesia arbuscula
Bud sage	Artemesia spinescens
Silver sage	Artemesia cana
Low sage	Artemesia nova
Horsebrush	Tetradymia sp.
Gooseberry	Ribes aureum
Squaw Currant	Ribes cereum
Squaw Carpet	Ceanothus prostratus
Willow	Salix spp.
Fern Bush	Chamaebetiaria millefolium
Mountain Mahogany	Cercocarpus ledifolius
Wild Rose	Rosa californicus
Chinquapin	Castanopsis sempervirens
Elderberry	Sambucus coerulea
Atriplex	Atriplex confertifolia
Greenleaf Manzanita	Arctostaphylos patula

Pinemat Manzanita	Arctostaphylos nevadensis
Cream Bush	Holodiscus discolor
Black greasewood	Sarcobatus vermiculatus
Sheep fat	Atriplex confertifolia
Shad scale	Atriplex canescens
Winterfat	Eurotia lanata
Spiny hopsage	Grayia spinosa

GRASS AND FORBS

Bluegrass Wheatgrass	Agropyron spicatum
Wheatgrass	Agropyron spp.
Mountain Brome	Bromus carinatus
Cheatgrass	Bromus tectorum
Rattlesnake chess	Bromus sp.
Pinegrass	Calamagrostis rubescens
Sedge	Carex spp.
Orchard Grass	Dactylis glomerata
Giant Wildrye	Elymus condensatus
Great Basin Wildrye	Elymus cinereous
Medusa Head	Elymus caput medusae
Idaho Fescue	Festuca idahoensis
Meadow Barley	Hordeum nodosum
Juncus	Juncus spp.
Prairie Junegrass	Koeleria cristata
Indian ricegrass	Oryzopsis hymnoides
Bluegrass	Poa spp.
Bulbous bluegrass	Poa bulbosa
Squirreltail	Sitanion hystrix
Neddlegrass	Stipa columbiana
Needle and thread grass	Stipa comata
Western Yarrow	Achillea lanulosa
Mountain Dandelion	Agoseris spp.
Wild Onion	Allium spp.
Dogbane	Apocynum spp.
Arnica	Arnica spp.
Milkvetch	Astragalus spp.
Arrowleaf Balsamroot	Balsamorhiza sagittata
Mustard	Brassica campestris
Common Camas	Camassis quamash
Painted Cup	Castilleia spp.
Thistle	Cirsium spp.
Larkspur	Delphinium spp.
Shooting Star	Dodecatheon spp.
Fireweed	Epilobium augustifolium
Eriogonum	Eriogonum spp.
Horse Weed	Erigeron sp.
Wolley Eriophyllum	Eriogonum lanatum
Alfilaria	Erodium cicutarium
Wild Strawberry	Fragaria spp.
Gilia	Gilia spp.
Western Rattlesnake Plantain	Goodyeara decipiens

Woolyweed	Hieracium scouleri
Prickly Lettuce	Lactuca serriola
Lily	Lilium spp.
Deer Vetch	Lotus spp.
Lupine	Lupinus spp.
Tarweed	Madia spp.
Common Hoarhound	Marrubium vulgare
Mint	Mentha canadensis
Monkeyflower	Mimulus spp.
Pentstemon	Pentstemon spp.
Phlox	Phlox spp.
Plaintain	Plantago spp.
Fivefingers	Potentilla spp.
Buttercup	Ranunculus spp.
Dock	Rumex spp.
Tumbling Russian Thistle	Salsola kalitenufolia
Saxifrage	Saxifraga spp.
Groundsel	Senecio spp.
Western meadowine	Thalictrum occidentale
Clover	Trifolium spp.
Vetch	Vicia spp.
Wooly Mulesear	Wyethia amplerecaulis
Violet	Viola spp.
Milkwort	Polygala subspinosa
Primrose	Oentheriz sp.
Balsamroot	Balsamorhiza sp.

APPENDIX 2

Presented at the 1958 Annual
Interstate Antelope Conference
September 18, 1958
Sheldon Antelope Refuge, Nevada

SEASONAL FOOD HABITS OF THE OREGON PRONGHORN ANTELOPE* (Antilocapra americana oregona Bailey)

by

Jim Yoakum
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Data pertaining to 189 antelope rumen samples collected from 1939 to 1956 was analyzed as to seasonal forage utilization. Only stomach content information from the pronghorn antelope (Antilocapra americana oregona Bailey) will be discussed. Bailey (1936:70) listed the common name of this subspecies as the Oregon pronghorn; consequently, this common name will be used in conjunction with its synonum Oregon antelope.

This study combines the findings of seven different collections, (see Table 1) and represents a complete calculation of all known data pertaining to the Oregon pronghorn's diet. Its' main objectives are to tabulate figures of seasonal forage utilization, provide a complete list of plant species eaten, and express vegetation consumption in volume percent and frequency of occurrence in percent.

The need for the above information becomes more critical as range and wildlife management annually intensifies on public lands. For example, 1958 was the beginning year for the following two new practices in the Bureau of Land Management's range resource surveys, each of which is directly correlated with big game food studies. First, the old practice of not inventorying vegetation in areas only accessible to game has been discontinued. The vegetation in areas only inhabited by game is now surveyed for the express purpose of properly determining game carrying capacity on Federal Ranges. Secondly, range resource survey techniques have been changed to not only inventory forage plants desirable for livestock, but to list all plant species; consequently, sufficient information can be obtained to practice dual-use grazing management by both livestock and big game as required by Part 161.5(b) of the B.L.M.'s Range Code (1956:5).

The question of determining Proper-Use-Tables for forage plants utilized by wildlife has been an item of continued reoccurrence. This has especially been true for antelope due to insufficient quantitative factual data pertaining to seasonal use and specific plants consumed. It is hoped that this paper will contribute substantially to such lacking knowledge.

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* Not for Publication.

The author received assistance from many individuals in order to accumulate records for this report. Mr. Charles Rouse, range specialist for the U. S. Fish and Wildlife Service, provided freely early collection studies from his personal files. Mr. Howard Leach, technician for the California Department of Fish and Game's Disease and Food Habits Laboratory, analyzed over three-fourths of the stomach samples personally and constantly encouraged completion reports for the findings. The extensive mathematical computations were accomplished by Mr. Reinard Okeson while working for the Bureau of Land Management and now a wildlife management student at Oregon State College.

HISTORY

The first Oregon antelope rumen samples were collected by Einarsen (1948:62) in southeastern Oregon during 1939. Einarsen's early work also included feeding observations. This technique has not been accomplished by any other worker to date and more findings of this type would greatly aid in a better understanding of food habit studies.

Subsequent collections to Einarsen's original work are illustrated in Figure 1 and Table 1. Of these studies, only Mason (1952) and Ferrel and Leach (1952) have been published. The remaining reports are in the author's files and scheduled to be published at the completion of this project's final report.

In 1950 the Interstate Antelope Conference (1950) accumulated all records of antelope food studies in their annual conference minutes. The findings were for pronghorns in California, Idaho, Nevada, and Oregon. State and federal government agencies representing these areas meet annually to form the Interstate Antelope Conferences. Although each state provided information, no attempt was made to combine or summarize the findings. This paper will summarize these findings and all subsequent studies known to date.

PROCEDURE

Each state's collections were entered by individual animal sample as to volume percent and frequency of occurrence of each plant species utilized seasonally. Occasionally it was necessary to compute these figures as not all reports were completed to this final step. The findings from the four states were then carried to an average column and tabulated.

Seasons of use were broken down as follows: winter represented December, January, and February; spring was March, April, and May; summer was June, July and August; while fall included September, October and November.

The listing of plant species was made by entering each plant as determined in the original analysis. This necessitated some duplication but represents the original findings.

Individual plants utilized were grouped into forage classes in order to maintain continuity throughout the report. These forage classes were designated as grass, forbs, and browse. Grass included the entire family of Gramineae as well as sedges and other grass-like plants. Moss, lichens, and cacti were classed with forbs; browse included trees as well as shrubs.

FINDINGS

The order of importance in volume percent of plants consumed was browse, forbs, and grass (see Tables 5 and 6). At least 82 plant genera and 46 species were noted in Table 3 which records frequency of occurrence in percent, for each individual plant consumed.

Grass: The greatest volume of grass was found in the animal's diet during fall (13.2%), then spring (9.2%) followed by winter (5.7%) while less than one percent was found in the summer. At no time did any cultivated Gramineae appear as more than one percent of the total stomach contents. Cheatgrass (Bromus tectorum) was the most frequently used grass according to analysis data. Generally speaking, grasses were not identified as to species due to the difficulty of keying after partial digestion.

The average volume of grass for the 189 animals was 7.0 percent.

Forbs: Forbs averaged 20.9 percent of all the antelope's diet with seasonal utilization as follows: winter 7.2%; spring 23.3%; summer 32.4%; and fall 21.0%. The most frequently utilized forbs were knotweed (Polygonum sp.), phlox (Phlox sp.) and poverty weed (Iva axillaris).

Although forbs included the largest number of different plant genera in the pronghorn's diet, the total volume was generally composed of trace amounts. Alfalfa (Medicago sativa) was the only cultivated forb identified. The amount represented in the final calculation illustrated that antelope had eaten less than one percent of this plant in their total diet.

Browse: Species of browse definitely composed the bulk of antelope food items. By seasonal utilization, browse provided 85.3% of the winter diet; 65.6% for the spring; 64.9% for the summer; and 59.1 for the fall. The year around average for all animals was 68.8%. In the order of their importance, sagebrush (Artemisia sp.) was first, bitterbrush (Purshia tridentata) was second, and rabbitbrush (Chrysothamnus sp.) was third.

For each season of the year, sagebrush averaged the highest volume percent of utilization. Rumen analysis studies disclosed that Oregon Antelope ate big sagebrush (Artemisia tridentata), black sagebrush (Artemisia nova), silver sagebrush (Artemisia cana), and low sagebrush (Artemisia arbuscula). Threetip sagebrush (Artemisia tripartita) can now be added to this list as the author was present when a hunter obtained an adult buck in Malheur County, Oregon on August 24, 1958 which contained this subspecies.

Trees were rarely represented in stomach contents. These were restricted to the Douglas Fir (Pseudotsuga menziesii) and juniper (Juniperus sp.).

DISCUSSION

It is recognized that rumen analyses are not the entire answer to food habit studies; however, they do provide the best knowledge that is presently available for antelope in the study area. No attempt was made to state that these are preferred or desirable plants for pronghorns. They are merely the findings recorded to date.

A point should be stressed before comparing extensively the findings from the different states. The information is limited in comparison due to the great difference in numbers of samples collected in different states and during the different seasons.

In interpreting food habits, data, one should consider ecological questions, such as plant availability, animal competition, and climatic influences. No animal diet study would be complete without this important correlated knowledge; consequently, a study of these factors will be undertaken. It is hoped that a preliminary report will be made of these findings at the 1959 Interstate Antelope Conference.

SUMMARY

1. Data pertaining to 189 antelope rumen samples collected from 1939 to 1956 was analyzed as to seasonal forage utilization.

2. The order of importance in volume percent of plants consumed was browse (68.8%), forbs (20.9%), and grass (7.0%).

3. At least 82 plant genera and 46 species were noted in the Oregon pronghorn's diet.

4. Grass was utilized the greatest in volume during fall (13.2%), then spring (9.2%), followed by winter (5.7%), and less than one percent in the summer.

5. No cultivated crops were found in antelope stomachs at any season in more than trace amounts.

6. Although forbs included the largest number of different plant genera, the total volume was generally composed of trace amounts of a wide variety of different species.

7. Browse species definitely comprised the bulk of volume for all plant species for all seasons of the year.

8. No attempt was made to correlate food habits data with ecological findings; however, this project will commence immediately.

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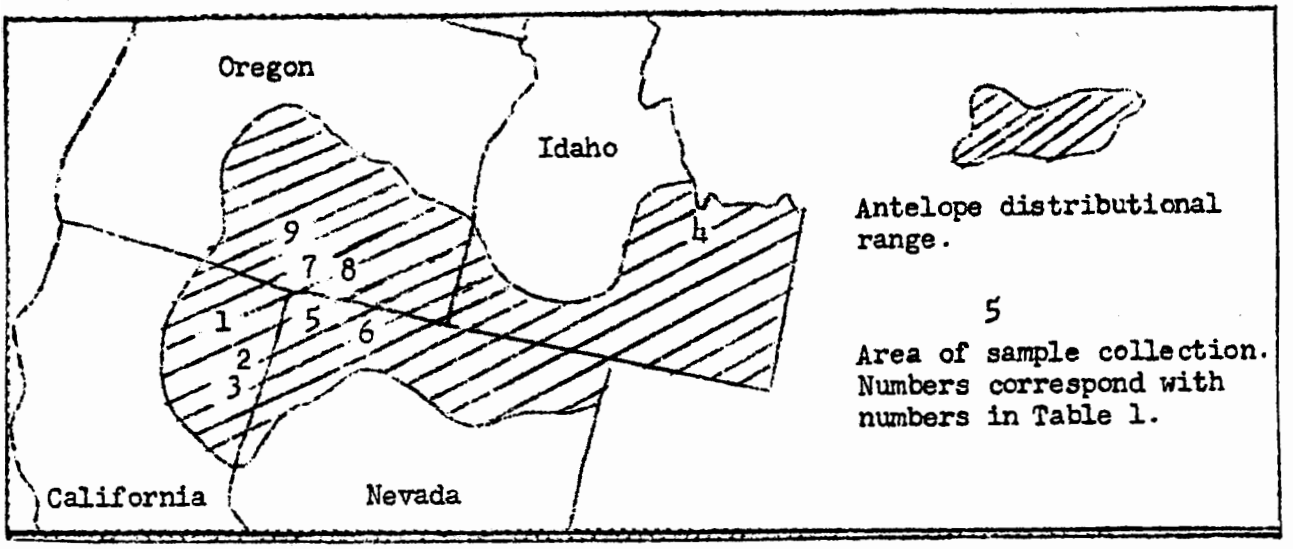


Figure 1. Antelope distribution and rumen collections for northern California, Idaho, northern Nevada, and Oregon.

Table 1. Pronghorn rumen sample collections for northern California, Idaho, northern Nevada, and Oregon.

NO.	STATE	YEAR OF COLLECTION	ANIMALS COLLECTED			COLLECTION AREA
			No. of Samples	Sex	Age	
1.	California	1942	20	-	-	Lassen and Modoc counties.
2.	California	1949	36	Male	Adult	Lassen and Modoc counties.
3.	California	1949	27	-	-	Lassen county.
4.	Idaho	1940	21	Male	Adult	Lemhi and Butte counties.
5.	Nevada	1941-42	11	-	-	Sheldon refuge.
6.	Nevada	1940	2	Male	Adult	Sheldon refuge.
7.	Oregon	1939 & 41	11	2 Females 8 Males 1 Unknown	-	Drakes Flat and Hart Mountain.
8.	Oregon	1950-51	26	24 Males 2 Females	Adult	Hart Mountain & vicinity, Harney county.
9.	Oregon	1955-56	35	12 Males 23 Females	34 Adult 1 Kid	Drakes Flat, Lake county.

Table 2. Seasonal Food Habits of 189 antelope expressed in Volume Percent.

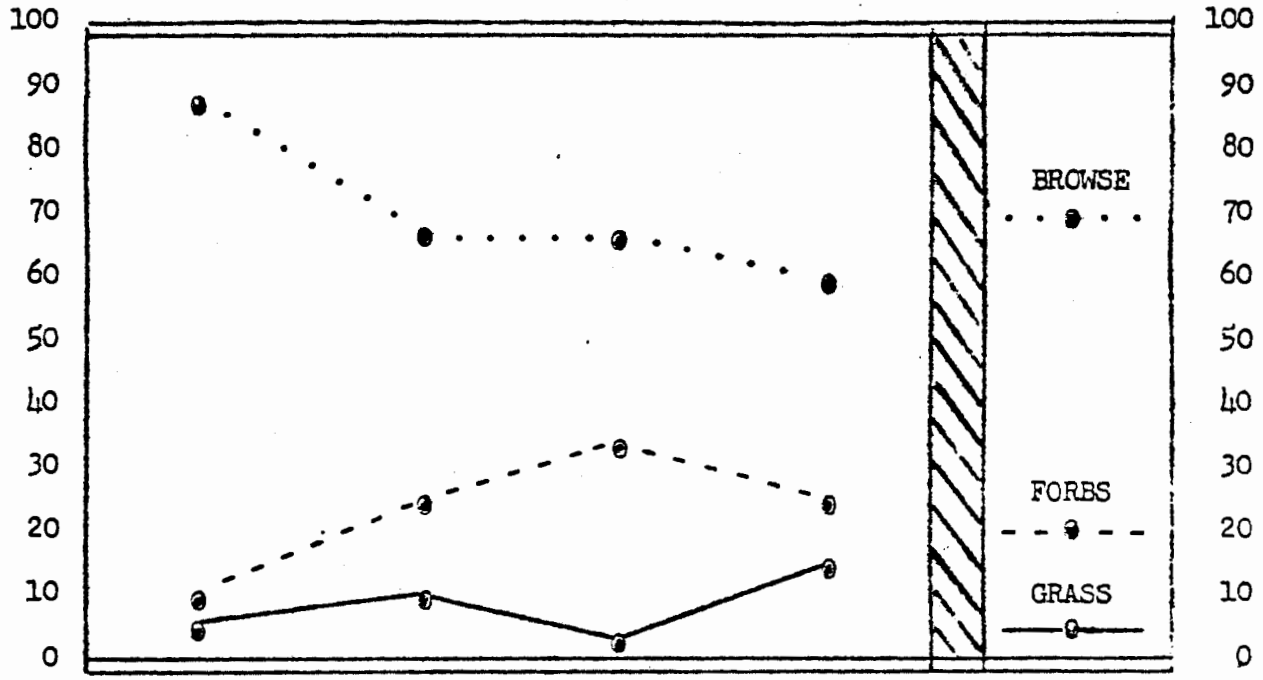
Common Name	Forage Class and Scientific Name	W	S	S	F
	No. of Samples	40	39	23	87
	Grass (includes Grass-like plants)	3.2	6.5	T#	1.9
Grass Family	Gramineae (green)	2.5	2.7		11.3
Grass Family	Gramineae (dry)	5.7	9.2	T	13.2
	Forbs (includes Moss, Lichens, and Cactus)				
Knotweed	Polygonum sp.			10.6	
Wiregradd	Polygonum aviculare				1.2
Sowbane	Chenopodium murale				T
	Salsola pustifor				T
Tumbling Mustard	Sisymbrium altissimum				1.3
Alfalfa	Medicago sativa			3.5	3.6
Clover	Trifolium sp.		T		
Hog fennel	Lomatium sp.		2.8		
	Carum sp.		1.4		
Phlox	Phlox douglasii	T	2.0	2.7	2.3
Phlox	Phlox sp.	T	6.2		T
Thistle	Haplopappus racemosus				T
Sunflower	Helianthus sp.		T		T
Balsam root	Balsamorhiza sp.		1.5		
	Lagophylla ramosissima				T
Poverty weed	Iva axillaris			4.5	4.3
	Eriophyllum lanatum				T
Sunflower Family	Compositae				T
	Erigeron austinae				1.0
English Plaintain	Plantaga lanceolata			3.6	
Cactus	Opuntia				1.0
Unidentified Forbs		7.2	9.4	7.5	6.3
	Total Forbs	7.2	23.2	32.4	21.0
	Browse (includes trees)				
Douglas Fir	Pseudotsuga menziesii				T
Sheep fat	Atriplex confertifolia	1.8			2.2
Grey Rabbit brush	Chrysothamnus nauseosus		1.3		T
Green Rabbit brush	Chrysothamnus viscidifolrus		1.4	5.8	T
Bitter-brush	Purshia tridentata	T	4.6	24.3	2.9
Big Sagebrush	Artemisia tridentata	57.4	55.9	34.8	41.1
Black Sagebrush	Artemisia cana				3.0
Low Sagebrush	Artemisia arbuscula	26.1	2.4		9.9
Unidentified Browse		T	T		T
	Total Browse	85.3	65.6	64.9	59.1

*W = Winter; S = Spring; S = Summer; F = Fall

#T = less than 1% of total volume but more than a trace. For a complete list of plants eaten, including traces, see Table 3.

Forage Class	Number Genera	Number Species
Grass	7	3
Forbs	60	27
Browse	15	16
TOTAL	82	46

Table 6. Numbers of individual plant genera and species by forage class in the Oregon antelope's diet.



	WINTER	SPRING	SUMMER	FALL	AVERAGE
No. Specimens	40	39	23	87	189(total)

Figure 2. A graphic representation of the Oregon antelope's food diet expressed in volume percent for seasonal utilization.

Table 3. Seasonal Food Habits of 189 antelope expressed in Frequency of Occurrence in Percent.

Common Name	Forage Class and Scientific Name	W	S	S	F
	No. of Samples	40	39	23	87
	Grass (includes Grass-like plants)				
Rattlesnake Brome	Bromus brizaeformis		2		
Downy Chess	Bromus tectorum	38	35	22	7
Brome Grass	Bromus sp.		7		3
Wild Barley	Hordeum sp.	5		4	
Cultivated Barley	Hordeum vulgare	2			
Squirrel Tail	Sitanion sp.			4	
Bluegrass	Poa sp.		7	4	
Spikerush	Eleocharis sp.				1
Rush	Juncus sp.			4	
Sedge	Carex sp.	2			2
Sedge Family	Cyperaceae		3		1
Grass Family	Gramineae (green)	39	66	39	19
Grass Family	Gramineae (dry)		62	22	55
Grass Family	Gramineae	4			4
	Forbs (includes Moss, Lichens, and Cactus				
Lily Family	Liliaceae		6		
Knotweed	Polygonum sp.		4	35	1
Wiregrass	Polygonum aviculare				5
Willow dock	Rumex sallicifolius				7
Dock	Rumex sp.	2	8	22	1
Buckwheat	Eriogonum sp.	13	23		7
Goosefoot	Chenopodium sp.				4
Sowbane	Chenopodium murale				2
Saltbrush Family	Chenopodiaceae	1	2	26	2
Russian Thistle	Salsola kali	19			2
	Salsola pustifor				6
Prostrate pigweed	Amaranthus blitoides			4	3
Buttercup	Ranunculus sp.		5		
Rockcress	Arabis sp.	4		4	3
Peppergrass	Lepidium montanum				2
Peppergrass	Lepidium sp.		5		4
Pennycress	Thlaspi arvense				2
Tumbling Mustard	Sisymbrium altissimum				2
Mustard Family	Cruciferae		7		2
Burnet	Sanguisorba annua		2		
Lupine	Lupinus sp.			22	2
Medick	Medicago sp.		5		
Alfalfa	Medicago sativa			4	5
Alfalfa and other forbs					4
Rattle-weed	Astragulus sp.		16	35	
Clover	Trifolium sp.		8	13	
Owls Clover	Orthocarpus sp.			8	
Vetch	Vicia sp.				2

Table 3. (continued)

Common Name	Forage Class and Scientific Name	*W	S	S	F
	No. of Samples	40	39	23	87
Red-stem Filaree	Erodium cicutorium		8		2
Filaree	Erodium sp.		3		3
Violet	Viola sp.			8	1
Willow Herb	Epilobium sp.				4
	Boisduvalia glabella				2
Primrose	Oenothera tanacetiflolia		2	4	
Primrose	Oenothera sp.		2	8	
Button snakeroot	Erynigium sp.		3		1
Hog fennel	Lomatium sp.		22	8	
	Carum sp.		2		
Parsley Family	Umbelliferae		3		
Bindweed	Convolvulus arvensis				1
Gilia	Gilia sp.		4	4	
Gilia Family	Polemoniaceae				1
Fiddleneck	Amsinchia sp.		2	4	1
Phlox	Phlox douglasii	4		4	13
Phlox	Phlox dolichantha		6		
Phlox	Phlox sp.	11	23	17	8
Phlox	Phacelia sp.		2		2
Nievitas	Cryptantha sp.				2
Borage Family	Boraginaceae				1
	Collinsia sp.		15	4	
Pentstemon	Pentstemon sp.				1
	Pentstemon deustus		7		2
Valerian Family	Valerianaceae		3		
Wild Lettuce	Lactuca sp.				4
Dandelion	Taraxacum vulgare		2		
Thistle	Crepis sp.				1
	Haplopappus racemosus				1
Sunflower	Helianthus sp.	9	2		2
Balsam root	Balsamorhiza sp.	15	3	4	
Balsam root	Balsamorhiza sagitta		2		
Arrowleaf	Wyethia sp.				1
	Blepharipappus scaber				4
Tarweed	Madia sp.				2
	Lagophylla ramosissima				4
Poverty weed	Iva axillaris	1	6	22	14
	Eriophyllum lanatum		5	13	4
	Eriophyllum sp.	6			1
Sunflower Family	Compositae	4	15	17	9
	Arnica sp.		2		
	Verbene sp.			4	
Yarrow	Achillia sp.			4	
	Senecio sp.		2	4	
	Monolepis sp.			8	
	Erigeron austinae		4	17	5
	Erigeron sp.		4		

Table 3. (continued)

Common Name	Forage Class and Scientific Name	*W	S	S	F
	No. of Samples	40	39	23	87
Caraway	Perideridia sp.			4	
Bird's beak	Corylanthus sp.			4	
Bedstraw	Galium sp.			4	
English Plantain	Plantaga lanceolata		4	4	
	Collomia sp.			4	
	Mertensia longifolia			4	
Cactus	Opuntia				13
Lichen	Lichen		2		
Moss	Bryophyta		2		1
Unidentified Forbs		17	12	31	40
Mustard	Rigiopappus leptocladus		2		
	Lesquerella sp.				1
	Browse (includes trees)				
Western Yellow Pine	Pinus ponderosa		2		
Sierra Juniper	Juniperus occidentalis	4	7	4	6
Juniper	Juniperus sp.		4	13	4
Douglas Fir	Pseudotsuga menziesii	2			4
Hop Sage	Grayia spinosa	7	3	4	
Sheep Fat	Atriplex confertifolia	38			19
Wild Rose	Rosa sp.		2	4	
Rabbit brush	Chrysothamnus sp.				9
Grey Rabbit brush	Chrysothamnus nauseosus	6	14	17	5
Green Rabbit brush	Chrysothamnus viscidifolrus	7	10	17	8
Manzanita	Arctostaphylos sp.		5		
Western serviceberry	Amelanchier almifolia		3		
Bitter-brush	Purshia tridentata	2	22	57	15
Big Sagebrush	Artemisia tridentata	33	33	87	81
Black Sagebrush	Artemisia nova		2		
Black Sagebrush	Artemisia cana			4	4
Low Sagebrush	Artemisia arbuscula				14
Small Sagebrush	Artemisia spinescene	15	4		
Greasewood	Sarcobatus vermiculatus	7			
Horsebrush	Tetradymia sp.			8	
	Tetradymia glabrata			8	
Snowberry	Symphoricarpus sp.				3
Unidentified Browse				4	11
Willow	Salix		2		

*W = Winter; S = Spring; S = Summer; F = Fall

Table 4. Seasonal Utilization of Forage Classes by States for Antilocapra americana oregona Bailey.

STATE	WINTER				SPRING				SUMMER				FALL			
	No. of samples	Grass	Forbs	Browse	No. of samples	Grass	Forbs	Browse	No. of samples	Grass	Forbs	Browse	No. of samples	Grass	Forbs	Browse
CALIFORNIA	27	1.9	2.3	95.8	20	1.6	34.8	63.6	-	-	-	-	36	1.0	52.1	46.9
IDAHO	-	-	-	-	-	-	-	-	-	-	-	-	21	15.0	32.1	52.9
NEVADA	5	4.4	19.4	75.8	2	8.0	-	92.0	-	-	-	-	6	36.5	4.8	57.0
OREGON	18	10.7	2.4	85.0	17	18.5	37.4	42.0	23	-	32.4	64.9	14	-	13.9	85.7

Table 5. Percent Volume of Forage Classes for 189 Antelope Rumen Samples Collected in California, Idaho, Nevada, and Oregon from 1939 to 1956

Forage Class	Percent Volume*				
	WINTER	SPRING	SUMMER	FALL	AVERAGE
Grass	5.7	9.2	T#	13.2	7.0
Forbs	7.2	23.3	32.4	21.0	20.9
Browse	85.3	65.6	64.9	59.1	68.8

* Plant species less than one percent in total volume not included.

A trace was found in the majority of the samples.

APPENDIX 3

A Draft Plan for Antelope Management in California[1/]

The California Department of Fish and Game has been managing the state's antelope resource without benefit of a formal management plan. Region 1 and 5, the regions containing the entire free roaming segment of this resource, conduct significant antelope managment activities. It seems desirable that a management plan outlining goals, parameters, management and research programs, and management and research needs be developed. Therefore, this draft is submitted for review, comments, and suggestions.

CALIFORNIA'S ANTELOPE MANAGEMENT PLAN

California's antelope population will be managed for the benefit and enjoyment of all the people of California. Perpetuation of a viable population of antelope will be the foremost consideration of the Department of Fish and Game. These management objectives will be achieved by a program of:

1. Preserving antelope habitat by opposing land use changes and/or zoning detrimental to antelope.

2. Retaining public lands which provide antelope habitat in public ownership.

3. Encouraging land exchanges and/or land purchases where feasible, which will add to antelope habitat.

4. Discouraging fences on antelope ranges and on antelope migration routes which might hamper the free movement of antelope.

5. Encouraging regulated livestock use on important antelope ranges to ensure that antelope are given primary consideration in forage allotments.

6. Conducting annual census surveys to determine the number of antelope in California.

7. Conducting annual herd composition surveys to determine herd ratios.

8. Providing information on areas where antelope can be viewed by the public.

9. Conducting special buck hunts based on a surplus buck concept, but only if a minimum of 200 permits can be issued.

10. Conducting either sex hunts in northeastern California regulate population to herd size objectives.

11. Maintaining each sub-herd at a maximum number that the habitat can efficiently support.

1/ Pyshora, L. 1977

12. Improving antelope habitat cooperatively with land administering agency of public domain or private owners.

13. Maintaining an active public informational program, and an antelope research program to determine:

    a. The effects of predation on antelope;

    b. Migration corridors to and from seasonal range areas;

    c. Kidding ranges;

    d. Potentials for improving habitat, including water supplies;

    e. The feasibility of transplanting antelope to increase the range area and population;

    f. What other state and agency data is available which could be useful and helpful to California's antelope management program.

    g. Participation in the Antelope Committee land workshop activities.

APPENDIX 4

MATHEMATICAL MODEL TO DETERMINE SURPLUS ANTELOPE BUCKS FOR SPECIAL HUNT QUOTA PROPOSALS[1/]

Determine herd composition percentage ratio by special hunt zone, from previous years aerial survey.

1. Determine antelope numbers by zone from latest winter aerial census.

2. Add previous years buck kill by zone to zone census totals.

3. Determine the number of bucks, does, and kids in each zone by using summer herd composition percentages.

4. Subtract buck kill of previous season if a hunt was held, from the number of bucks, by zone.

5. Divide the number of kids by two and add one half of the kids to the buck total and one half to the doe total by zone.

6. Determine the number of bucks needed for breeding by multiplying .20 times the number of does in the zone.

7. Subtract the number of bucks needed for breeding from the buck total. The result and figure indicated surplus bucks on which to base hunting season quotas. Hunt quotas are based on 75 percent of the surplus bucks, except as noted below.

NOTES:

In zone 3, Surprise Valley, it will be necessary to determine hunt quotas from summer herd composition data only as winter census data is usually not avilable for this area (antelope summering here normally winters in Nevada). Permits for zone 3 will be additional to those determined by using winter census data.

Census data for zone 4 includes those antelope that summer in zone 5. Therefore, when computing hunt data it is necessary to combine herd composition data from these two zones. Based on experience, twenty percent of the "surplus buck" quota from the total of these two zones is alloted to zone 5.

Some of the antelope summering in zone 4, near Madeline, apparently winter in zone 2 (Likely Valley and/or Likely Tables). Therefore, the surplus buck quota for zone 2 will be high and the quota for zone 4 will be low, as determined by this formula. The zone 2 quota should be reduced to 60 percent of the surplus bucks and the zone 4 quota increased to 100 percent. This has proven to be an adequate system based on past hunts, however, more refined migration data are needed for this specific area.

The data and the formula used for computing 1972 special hunt quotas is attached.

1/ Prepared by L. Pyshora, Wildlife Management Branch, Region 1.

TABLE I

ANTELOPE HUNT QUOTA - ENTIRE HUNT AREA

1. Winter Census (1972) 3,764

2. 1971 buck kill 288
4,052

* Summer 1971 herd ratio = 42 bucks/100 does/38 kids
23.34 /55.51 /21.15

3. Number of bucks 23.34 x 4,052 = 946
Number of does 55.51 x 4,052 = 2,249
Number of kids 21.15 x 4,052 = 857
4,052

857 kids divided equally to bucks and does
(857 x .50 = 428.5)

946 bucks + 428 = 1,374 buck incl. yearling
2,249 does + 429 = 2,678 does incl. yearling
4,052

Bucks 1,374
Less 1971 kill- 288
1,086
+ Does 2,678
3,764

Bucks needed for breeding 2,678 x .20 = 536

Total bucks less breeders = surplus buck

1,086 - 536 = 550 x .75 = (412.5 hunt quota)

* Does not include zone 3.

Data by zone is figured in an identical manner to the entire herd area data, except for modifications for zones 2, 3, 4 & 5, as noted in the text.

TABLE II

Winter Census Data - Antelope Locations by Zone

Zone	Locations
1	Mt. Dome
	Macdoel
	Red Rock Valley
2	Clear Lake
	Red Lake
3	Likely Tables
	Rocky Prairie
	Cedar Pass
	Likely Valley
	Davis Creek
	Rattlesnake Creek
4	Susanville "L"
	Pete's Valley
	Little Mud Flat
	Shaffer Mountain
	Skedaddle
	Shinn Ranch/Smoke Creek
	3 & 5 Springs
	Snowstorm
	E & SE Black Mountain
5	Dixie Valley - Pittville Flats
	South of Bieber (Big Valley)
	Fox Mountain
	South of Pittville
6	Cowhead
	Snake Lake

TABLE III

SUMMER HERD COMPOSITION DATA - LOCATIONS BY ZONE

Zone	Locations	County
1	Mt. Dome	Siskiyou
	Red Rock Valley	Siskiyou
	Macdoel	Siskiyou
	Big Table Land	Siskiyou
	Lava Beds N.M.	Siskiyou
2	Engle Swamp	Modoc
	Lava Beds N.M.	Modoc
	Blue Mountain Meadow	Modoc
	Casuse Mountain	Modoc
	Doublehead Lake	Modoc
	Boles Creek	Modoc
	Steele Swamp	Modoc
	Clear Lake (Perimeter)	Modoc
	Clear Lake (Peninsula)	Modoc
	Clear Lake Hills	Modoc
	Faine Ranch	Modoc
	Clear Lake (No. end)	Modoc
	Johnson Reservoir (W. of Carr Butte)	Modoc
	Timbered Ridge	Modoc
	Kellogg Mountain	Modoc
	Baseball	Modoc
	No. of Timbered Ridge	Modoc
3	Davis Creek	Modoc
	Joseph Creek	Modoc
	Cedarville "Y"	Modoc
	Dorris Reservoir	Modoc
	Likely Tables	Modoc
	Rocky Prairie	Modoc
	Quigley Ranch (T43N, R10E, Sec. 33 & 36)	Modoc
	Beeler Duncan (T41N, R12E, Sec. 10)	Modoc
	Enderline Ranch	Modoc
	O.D. Morgan Ranch (T42N, R13E, Sec. 31)	Modoc
	Big Sage Reservoir	Modoc
	Thomas and Ranker	Modoc
	Dead Horse Reservoir	Modoc
	Telephone Flat	Modoc
	No. of Telephone Flat	Modoc
	Likely Valley (So. of Likely)	Modoc
	Alturas Airport (USFS)	Modoc
	Antelope Reservoir	Modoc
	Clover Swale	Modoc
	Quaking Asp Spring	Modoc
	Surveyors Valley	Modoc
	M & N Reservoir	Modoc
	Fairchild Swamp	Modoc
	Reservoir F	Modoc
	Ambrose-Canby Rim	Modoc
	Spaulding Reservoir	Modoc
	Deer Hill (Willow Valley)	Modoc

TABLE III (cont.)

Zone	Locations	County
4	Painter Flat	Lassen
	Shinn Ranch	Lassen
	Rush Creek Mtn.	Lassen
	Horse Lake	Lassen
	Five Springs Mtn.	Lassen
	Little Mud Flat	Lassen
	Karlo Mesa	Lassen
	Jenkins Ranch	Lassen
	Pete's Valley	Lassen
	Snowstorm	Lassen
	Eagle Lake	Lassen
	Grasshopper	Lassen
	Madeline Plains	Lassen
	Silva Flat	Lassen
	Champs Flat	Lassen
	Harvey Valley	Lassen
	Gray's Valley	Lassen
	Swain's Hole	Lassen
	Pine Creek-Bogard Flat	Lassen
5	Round Valley	Modoc
	Lookout Dump	Modoc
	Lower Roberts Reservoir	Modoc
	Fox Mountain	Modoc
	Ash Creek	Lassen
	Big Valley	Lassen
	Muck Valley	Lassen
	Pittville Flats	Lassen
	Dixie Valley	Lassen
	Egg Lake	Lassen
	McKay Flat	Lassen
	Pittville	Shasta
	Bald Mountain	Shasta
6	Fee Reservoir	Modoc
	Mud Lake So. of Cowhead Lake	Modoc
	Cowhead Lake	Modoc
	Snake Lake	Modoc

APPENDIX 5

Antelope Depredation Contingency Plan[1/]
Region 1

July 1978

The pronghorn antelope population in northeastern California has increased by 230 percent since 1959. During this same period conversion of antelope range to more intensive agricultural management has increased. The combination of more antelope and reduced antelope range has resulted in increased antelope depredation on agricultural crops primarily standing alfalfa. Except for depredation hunts, there is no legal method for landowners to effectively control depredation. A contingency plan is needed in order to deal with the depredation problem.

To date, two actions have been taken regarding antelope depredation: 1) A bill was introduced in the legislature in 1977 to amend Section 4181 of the Fish and Game Code adding antelope to the list of animals which can be taken under authority of a depredation kill permit. This bill was approved by the legislature but was vetoed by the governor. 2) Seventy-seven antelope were live-trapped near Goose Lake in Modoc County to alleviate a chronic depredation problem. Most of the animals were relocated to Lassen County. The trapping and relocation project was successful in relieving depredation, at least for the present time. (Unpublished report, Pyshora, 1977). This method was expensive, however, costing about one hundred dollars per animal.

There are several possible alternatives available in attempting to handle future depredation problems--no one method will be suitable for all situations. Consequently, we need to retain some flexibility in handling antelope depredation.

Population management should be a primary consideration. We are in the process of delineating the northeastern California antelope range into biological units. When this is accomplished, antelope population goals should be established for each unit and the unit managed toward that goal. Controlling populations within carrying capacity should aid in reducing depredation. Population controls would necessitate the harvesting of female animals as part of the hunting program. It is anticipated that either sex harvest will be controversial.

Depredation hunts are a possibility in certain situations. If an area is large enough to hold such a hunt safely, damage can be temporarily alleviated. This type of hunt must result in a substantial reduction of the group of antelope involved in order to provide depredation relief. Again, this would necessitate the harvest of animals of both sexes, with the attendant public relation problems. This will also require a willingness of ranchers suffering depredations to allow public hunting.

1/ Prepared by Leo Pyshora, Associate Wildlife Manager-Biologist, Region 1

Relocating problem animals is an alternative. As previously stated, this is an expensive process and must be contingent upon having a suitable area for translocation of the animals. Suggested relocation priorities are as follows:

1) Reestablishment of populations in suitable historic range in California or to supplement animals in areas of low populations, if suitable range exists.

   A resurvey of historic California antelope range should be made to determine where suitable sites for reestablishment exists.

2) Exchange with other states for other species of wildlife.

Fencing can prevent depredation, as a standard 42-inch hog wire fence will effectively turn antelope. Under certain situations this alternative is the most suitable method of controlling depredation.

Antelope-proof fencing is best suited to situations where individual fields within larger areas of antelope range are involved. Fencing of larger land blocks or fencing of travel routes could be very detrimental to the animals and might not be necessary to alleviate damage. Fencing should not be considered in migration routes except where individual fields can be protected without impeding antelope movement.

We encourage landowners to fence fields where damage is expected to occur. However, ranchers are reluctant to fence or improve existing fencing to more than bare minimum needs unless someone else pays at least part of the cost.

Scare devices such as "Zon" guns and cracker shells sometimes provide short-term relief. Our experience has been that they are largely ineffective after one or two days. Antelope seem to become accustomed to the noise in a very short time.

Herding by auto, airplane and horseback has been attempted. This means of depredation control provides short-term relief as animals return almost immediately after the harassment ceases.

Land use zoning is an alternative that has considerable merit. With the increased demand for development of additional agricultural area, summer homesites and "ranchettes" we can expect undeveloped private lands to be developed for such purposes in the future. When small holdings surrounded by wildlands are developed, depredation is likely to occur. One way to forestall resulting complaints would be a form of zoning which would designate large areas of presently undeveloped lands as places where development would be at the developer's risk. Within such zones, no depredation permits would be issued and the landowner would be required to provide his own protection within the constraints of the law. Obviously, legislation would be required to implement this kind of program but the idea warrants exploring.

We are working with counties regarding open space plans and large acreage type zoning for important wildlife areas. All too often, however, our proposals and/or suggestions are ignored if the landowner proposes a land use change that will increase the taxable value of the property.

Habitat development is an alternative, but one of which we have little knowledge. There would seem to be potential for development and/or improvements of habitat on public lands which could attract animals from agricultural lands. We are presently working cooperatively with the Bureau of Land Management in Modoc County to open up a dense juniper stand to provide an area for antelope that have been displaced by agricultural developments on their winter range. We do not know if this will be successful as this project has not been in effect long enough to determine its value.

Elimination of predator control programs designed to protect livestock warrants consideration. Such programs may be a factor in the rapid increase in antelope numbers.

In areas where crop damage by antelope is a problem and predator control is being done, cessation of predator control, primarily coyote control, could result in a less rapid increase in the antelope population. It has been demonstrated (Pyshora, 1977) that intensive coyote control can result in a rapid short-term increase of an antelope population. However, predator control is a popular program with local ranchers and sportsmen. Any move to curtail predator control could meet with strong resistance.

Based on the foregoing discussion, it is recommended that:

1. The northeastern California antelope range be divided into biological units. An antelope population level will be set for each unit and the antelope harvest managed accordingly. In those biological units with significant depredation problems, the population should be controlled by hunter harvest to keep antelope populations within tolerable levels. This does not mean that the antelope population should be reduced significantly from present levels specifically to control depredation. What it does mean is that populations be controlled so that they are healthy, productive and thrifty, which should provide some relief from depredation.

2. Historic antelope ranges in California be resurveyed to determine if suitable areas are available for restocking. Wildlife Management staff should undertake this survey.

3. Fencing be encouraged where the free movement of antelope will not be seriously impeded. The department should work directly with agriculturists to encourage such fencing and if possible assist in obtaining financial support through ASCS, SCS, or others.

4. Groups of problem animals be translocated to suitable historic ranges and/or ranges with remnant populations within California. We may be forced to move animals if relief is demanded by the landowners and for some reason a depredation hunt cannot be held. Since property owners have no legal recourse except for depredation hunts, they could bring extreme pressure to bear to have problem animals relocated.

5. Other western states be canvassed to determine if they have a need for antelope through some type of wildlife exchange program if no suitable release sites are available in California.

6. We encourage appropriate land use zoning for antelope range as a continuing effort with county governments.

7. Legislation be reintroduced to have antelope included as a species for which depredation kill permits can be issued. However, this legislation should be worded so as to allow department employees some discretion in when to issue permits. The present legislation requires the Department to issue a kill permit for "damage or threatened damage". This gives us no choice but to issue depredation kill permits on demand.

8. Scare devices be used only as very short-term control. This technique is relatively ineffective in solving depredation problems but may have some value in placating the landowners.

9. Depredation hunts be used only if a large enough area is available in which to safely conduct a hunt. It must be recognized that such hunts provide short-term relief at best, and are controversial.

10. We continue to work with habitat improvement to determine if animals can be moved from depredation areas by this means.

11. Aggressive efforts to resist range conversion proposals on public lands which would be unfavorable to antelope should be continued.

12. Predator control efforts be discontinued in specified areas where antelope depredation is occurring in order to determine if allowing an increase in predator population will influence antelope population trends.

13. Zoning ordinances of other states be reviewed to determine if suitable "pattern" ordinances are presently in use that we can use as examples.

Implementation

In order to trap and relocate antelope we will need a suitable antelope trap. A fund for helicopter rental will also be needed. Helicopters are necessary to herd antelope into the trap. Additional manpower and/or reallocation of existing manpower will be necessary, as a large number of personnel are required for this type of program. A budget request has been submitted for materials to construct a trap. If approved, it will be constructed in 1979-80.

Zon guns should be purchased by the Department to loan out for short-term depredation control. Three Zon guns have been requested in the 1979-80 budget.

Suggested legislation has been prepared for consideration regarding the issuance of depredation kill permits for antelope as outlined in recommendation #7.

We are currently redefining antelope herd biological boundaries as outlined in recommendation #1. This realignment will be completed in 1979.

An antelope population computer model has been developed cooperatively with U.C. Berkeley. The model can be used in conjunction with recommendation #1--population control by biological units.

APPENDIX 6

AERIAL MARKING OF ANTELOPE FOR MIGRATION AND DISTRIBUTION STUDIES

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Introduction

An estimated 140,000 antelope range over almost half of the total land area of Wyoming. The distribution and population density of the antelope herds varies seasonally throughout this vast area. It has become increasingly important to gain a sound knowledge of their migration routes and seasonal distribution to effect optimum management practices on this important Wyoming big game animal.

Various methods of marking antelope for migration and distribution studies have been experimentally used in Wyoming. These include the ear-tagging of new-born fawns, ear-tagging and hair-dye marking of animals captured in livetraps, and aerially marking antelope with hair dyes.

Aerial application of hair dyes seemed to offer the most practical and economical technique for marking animals in the field. A permanent hair dye was needed which could be successfully applied onto antelope herds from an airplane. It should also be plainly visible on animals so marked when seen by either ground or aerial observations.

This paper will outline a method of aerially marking antelope with a permanent hair dye. While further refinements in the technique are anticipated, this method has been used successfully in several areas of Wyoming for determining seasonal herd shifts. It should be useful in other sections of our western antelope ranges.

Materials and Methods

Initial attempts to aerially mark antelope in Wyoming utilized an oil soluble red dye mixed with fuel oil (Wrakestraw and Baker, 1952). This material was successfully applied from an airplane on part of a group of animals confined in a large fenced pasture. The red color was plainly visible for several days but soon faded and the material proved impractical for permanent marking. These early attempts recognized the usefulness of aerial marking but due to a lack of adequate hair dyes, the method was temporarily suspended.

A permanent hair dye, known as Nyanzol (trade name), was being used by the livestock industry (Schoonover, 1954). It offered some promise for marking antelope. A University of Wyoming wildlife student employed this dye in a study on coloring live hairs of big game animals (Wenzel, 1954). Experimental field testing indicated it had permanency of color on antelope hair.

Further experimental marking of captive antelope using the Nyanzol powder was done at the Wyoming Game and Fish Department's Sybille Game and Fish Experimental Unit (June, 1959). This powder, when mixed with proper

proportions of gum arabic and hydrogen peroxide, produces a permanent hair dye. It was found to retain its black coloration on live antelope for extended periods of time. No undesirable toxic effects on these animals were noted.

It was decided to perfect techniques of aerial application utilizing this dye and evaluate its use in determining migration and distribution patterns of specific antelope herds.

Nyanzol "D" black powder, purchased from the Nyanza Color Company, 549 W. Randolph, Chicago, Illinois, was used in these marking experiments. The gum arabic in granulated form and 3 percent hydrogen peroxide solution were obtained at chemical supply houses. Dye lots, approximately 17 gallons each, were prepared for aerial application as follows:

1. Dissolve 7.5 pounds of the Nyanzol "D" powder in 5.5 gallons of hot water.

2. Dissolve 7.5 pounds of the powdered gum arabic in 5.5 gallons of warm water. This material acts as an adhesive agent.

3. The Nyanzol and gum arabic solutions are mixed together and poured into the spray tank of the airplane.

4. Just before take-off, 5.5 gallons of 3 percent hydrogen peroxide were added to the tank. This material acts as a color fixative agent.

In preparing the dye solution, several techniques were discovered that expedited the operation. The gum arabic was mixed into its water solution with the aid of a paddle type mixing rod used in a slow speed, one-half inch electric drill. The Nyanzol powder tends to crystallize and form a precipitate on cooling so the entire mixing operation was performed just before the airplane took to the air. An agitator pump attached to the spray rig kept the solution mixed during actual flight and effectively prevented any precipitate from forming. It is necessary to flush the spray tank and boom with water after each operation.

It is suggested that personnel preparing the spray use rubber gloves and old clothes. Its color permanency was demonstrated most successfully on individuals who had come in contact with the dye on their hands and clothing. The dye should be mixed outside or in a building where accidental dye marks would be unimportant. It was also necessary to cover the spray plane with a temporary coat of non-detergent oil before loading and spraying operations to effectively protect its surface areas.

The value of the dye and chemicals used in each 17 gallon lot was estimated at $30.00.

Two planes were used in the spraying operation, A Cessna 180 and a 150 Super Cub. A commercial-type spray tank was mounted in the rear seat of the Super Cub. After several modifications of the spray boom, a single outlet, one-half inch boom was found to be most satisfactory when mounted on the left side of the spray plane. The large aperture permitted a heavy flow of dye from

the nozzle. This was satisfactory in getting the mixture onto the running animals.

The outlet boom should not be mounted beyond the flap area on the wing but should be placed several feet from the fuselage. This permits the pilot to see it while spraying animals. The boom itself should have a bend at the end extending downward. The discharge end of the boom is cut at a 45 degree angle to further aid in concentrating the discharged spray. Mounting the spray end of the boom so it would be pointed down during level flight proved beneficial.

The spray rig incorporates a three-quarter inch discharge, air-driven centrifugal pump with a by-pass regulator and a positive on-off valve mounted in the cockpit. Discharge pressure was maintained at approximately 20 pounds while spraying.

The successful application of dye on running animals is highly dependent on pilot skill. The department was fortunate in having two pilot employees with a great deal of agricultural spraying experience which proved beneficial in this operation. Every precaution must be taken to assure pilot safety. Attempts should not be made to spray animals in rough terrain or during windy weather. We found early morning and late evening hours to be the best time for application. Movements of the two planes were closely coordinated through radio communication. The technique for application is outlined as follows:

1. A herd from 20 to 40 antelope was located in the operation area.

2. The Cessna 180, flying high, would move onto a herd and move them until they were running at a fairly constant speed in a straight line. The Super Cub would fly low during this time, waiting on instructions for the spray run from the pilot of the Cessna.

3. After the animals were running in a desirable direction over relatively flat terrain, the Cessna pilot would direct the spray plane pilot to make his spray run. The pilots would orient themselves so they could swoop over the herd with the Cessna flying to the left of the running antelope in a hazing position and the spray plane approaching the herd from the right side.

4. As the spray plane approached the herd from the rear, the pilot would drop down to a level 4 to 10 feet above the running animals and move directly over and slightly to the right of them before releasing the spray.

The dye material would flow from the boom nozzle, spread out in a heavy spray, and hit the running animals about the face, chest, back and on their right sides. Several attempts were made to spray animals in the originally located herd, or in other herds, until all of the dye lot had been depleted.

The relative success of each spray run could usually be determined by the pilot and single observer in the hazing plane. This information was relayed to the spray plane pilot by radio.

Findings

Winter antelope herds were sprayed at three widely separated locations during March and April of 1960 to evaluate and perfect the marking techniques. One spray site was located southeast of the town of Lusk in Niobrara County. Another one was selected at Ormsby Flats northeast of Casper in Natrona County and the remaining site in the Sagehen Creek drainage of Fremont County.

Immediately following the spraying operations, several aerial flights were made in and adjacent to these locations to estimate the number of animals marked at each site and to determine if they could be readily identified by aerial observation. Periodic ground and aerial observations were made at later dates to locate marked animals and evaluate herd movements.

A dye lot of 17 gallons had been used for spraying antelope in the Sagehen Creek area. An aerial flight in this location a day after the marking attempt disclosed at least 14 well marked, black spotted antelope that could be easily identified from the air. Markings were most noticable around the face, shoulders, back and on the right sides of the animals. Additional antelope were seen which required closer scrutiny for identification. An estimated 25 head were marked at this location.

Laber observations were made on animals originally marked in the Sagehen Creek locality. These showed that the color persisted until at least mid-May. It was noted that normal shedding of winter pelage and the resulting dark appearance of clumps of shed hair on the backs and sides of animals made identification of marked animals more difficult. While marked animals could be correctly identified by careful observation, it was obvious that a dye color other than black would be advantageous.

Detailed observations and herd movements are illustrated on the project job completion report for this operation (Crump, 1960). Several unconfirmed reports were made to department personnel on marked antelope sightings which could have originated at the Sagehen spray site. These were so widely scattered that credulence in them was tempered. On May 14, a reliable sighting of nine head of marked antelope was made by department ground observers. These animals were seen several times in small herds on the headwaters of Cabin Creek on the north side of the Rattlesnake Mountains.

The location of marked antelope in the Cabin Creek drainage shows a positive movement of at least a portion of the wintering Sagehen Creek herds eastward and over the Rattlesnake Mountain divide. This involves an airline distance of about 30 miles.

Several herds of antelope were sprayed in the Ormsby Flats area in early April utilizing a 17 gallon dye lot. These operations were conducted under somewhat undesirable flying conditions. It was estimated that some 20 head of animals were marked in this attempt. On May 6, an aerial observer located three head of marked antelope from the Ormsby Flats operation approximately 20 airline miles northwest of the spray site. While the movement of antelope from the marking site toward the northwest had been suspected from ground observations in past years, this movement was authenticated by the marking operation.

Additional antelope were sprayed in the winter of 1961. The amount of dye sprayed at the study site was increased to mark a greater number of animals. Close, periodic observations on these marked animals to date have revealed significant movement patterns. The increase in the number of marked animals has been valuable in more closely evaluating the extent of herd movements as the chances of seeing marked antelope in the field are greater.

The season of dye application is important as animals lose their pelage markings upon the normal spring shedding of winter hair. Attempts should be made to mark animals in the early fall months prior to their movement onto winter ranges. This will afford an additional length of time in which to observe marked antelope. In specific cases, late winter marking may be most valuable in determining movements from winter to summer ranges.

Results of this study indicate that the black markings resulting from the Nyanzol dye may be confused with clumps of shed hair by casual observers. It is suggested that experiments be conducted with dyes of like permanency but of different colors to alleviate this factor.

The basic technique for aerial application of the dye material appears to be satisfactory. It has been suggested that the downward nozzle of the spray boom be increased in length. Then the pilot would not be required to fly as low for application. This suggestion was made after an antelope was hit by one of the landing wheels on a spray plane. The observer in the hazing plane noted in this case that one of the antelope running in the herd had leaped into the air in attempting to get ahead of others in the string. The lengthening of the spray nozzle would help alleviate this potential source of danger in future operations.

By utilizing techniques and observing precautions outlined in this text, the aerial marking of antelope offers a positive method of determining information on the seasonal distribution of antelope herds. An evaluation of findings in this report reveals several significant herd movements which will be of importance to game managers regulating these herds. This technique may be of value to other conservation departments with antelope populations.

Summary

Experimental studies on aerial application of hair dyes have been conducted in Wyoming. A commercial dye, Nyanzol "D" black powder, was used to mark antelope. This dye marked the hair of animals with a black coloration that could be identified by aerial or ground observations. Techniques were devised for the aerial application of the dye solution which have proven satisfactory.

Several significant herd movements and seasonal distribution patterns have been determined utilizing this technique. It is suggested that aerial spraying of antelope offers a more practical and economical method of marking animals for antelope movement studies than live-trapping for marking or fawn marking operations.

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