Proceedings of the Thirteenth Biennial

PRONGHORN ANTELOPE WORKSHOP

May 31 - June 2, 1988
Hart Mountain
Antelope Refuge

OREGON DEPARTMENT OF FISH AND WILDLIFE

PROCEEDINGS

OF THE

THIRTEENTH PRONGHORN ANTELOPE WORKSHOP

Hart Mountain, Oregon
May 31 - June 2, 1988

Chairman
Dan Eastman

PREFACE

The 13th Western States Pronghorn Antelope workshop was held on Hart Mountain Antelope Refuge, Oregon, on May 31, June 1, and June 2, 1988, and was hosted by the Oregon Department of Fish and Wildlife and the U.S. Forest Service. Forty-three people representing eight states, one Canadian province, three federal agencies, two universities, one Indian Tribe, and one federal representative from Australia attended the workshop.

Reports on pronghorn antelope population status were presented by the nine attending state and province representatives. Eight technical reports and two panel discussions were presented and are presented in the proceedings. Portions of the discussions were lost due to noise interference caused by airplane flyovers and from some audio equipment problems.

Al Polenz

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Summary of Pronghorn Workshops held to date.

MEETING DATES AND LOCATIONS	NUMBER OF ATTENDEES	CHAIRMAN	HOST AGENCY
April 14-16, 1965 Santa Fe, New Mexico	18	W. Huey	New Mexico Department of Fish and Game
February 16-17, 1966 Denver, Colorado	32	G.D. Bear	Colorado Game, Fish and Parks Department
February 5-6, 1968 Casper, Wyoming	97	J.L. Newman	Wyoming Game & Fish Commission
January 27-28, 1970 Scottsbluff, Nebraska	85	K.E. Menzel	Nebraska Game & Parks Commission
June 19-22, 1972 Billings, Montana	85	H.O. Compton	Montana Fish & Game Department
February 19-21, 1974 Salt Lake City, Utah	52	D.M. Beale	Utah Division of Wildlife Resources
February 24-26, 1976 Twin Falls, Idaho	68	R. Autenreith	Idaho Department of Fish and Game
May 2-4, 1978 Jasper, Alberta	84	M.W. Barrett	Alberta Fish & Wildlife Division
April 8-10, 1980 Rio Rico, Arizona	64	J.S. Phelps	Arizona Game & Fish Department
April 5-7, 1982 Dickinson, North Dakota	69	J.V. McKenzie	North Dakota Game & Fish Department
April 10-12, 1984 Corpus Cristi, Texas	45	C.K. Winkler	Texas Parks & Wildlife Department
March 11-13, 1986 Reno, Nevada	43	M. Hess	Nevada Department of Wildlife
May 31-June 2, 1988 Hart Mountain, Oregon	43	D. Eastman	Oregon Department of Fish & Wildlife

PROVINCIAL AND STATE REPORTS

ALBERTA PROVINCIAL REPORT

Bill Glasgow, Unit Leader, Deer and Antelope Management
Alberta Fish and Wildlife Division, Edmonton

Distribution of Antelope

The general distribution of antelope in Alberta, reported in the 1980 Proceedings of the North Biennial Pronghorn Antelope Workshop (page 208), has changed very little. However, local distribution has changed in response to cultivation of short grass prairie habitat. Some of the cultivated fields are planted with fall rye and winter wheat and attract animals in the fall before snowfall and again in the spring but are little used during other periods.

Antelope Population Estimate/Trend

Recent population estimates are presented in Table 1, indicating populations have been very high in Alberta in recent years. The trend has been a steady increase in the population from the mid 1970's to the present. There has been only one decrease in that period, from 1984 to 1985, resulting from higher then average winter morality.

Productivity/Recruitment

Productivity as measured by fawns per 100 does (Table 1) has been relatively constant, ranging from 54 to 68, over the past 10 years, except for 1979 when it was very high for Alberta at 91. Recruitment has been well above average in response to above average temperatures and below average snowfall for most winters since 1973/74, resulting in the steady population increases shown in Table 1.

Harvest Strategies/Results

Hunting is allocated using a limited-entry draw. Hunters may apply for both a Trophy Antelope Special License (for bucks with horns greater than 5") and a Non-trophy Antelope Special License but may hold only one (the trophy draw

goes first so those successful in this draw become ineligible for the non-trophy draw). Numbers of hunters in each of the eight management areas is determined by how many are needed to reduce the herd to post-season population goals. However, this number has exceeded predetermined hunter density limits in recent years for the Non-trophy season. Conforming to these hunter density limits has resulted in harvests (Table 1) well below those desired to bring the population down to the post-season goal of 18,000.

To increase the harvest in 1987 the Trophy license holders were allowed to purchase a non-trophy quota license and tag and Non-trophy license holders were issued 2 tags. There were 3400 trophy licenses issued (3800 applied) and they purchased 2200 non-trophy quota licenses. There were 3600 non-trophy licenses issued (4700 applicants). The result was a harvest of 2500 trophy antelope and 5200 non-trophy antelope, bringing the post-season population down to 18,500. The success rate with 2 tags was 1.02 non-trophy animals per hunter compared to 0.74 when single tags were issued in the past.

Planning and Research

The Province of Alberta has a draft management plan for antelope that is scheduled for completion in 1988. There is currently no ongoing research, but a Master's Degree entitled "The Effect of Burning Northern Mixed Prairie on Pronghorn Antelope Range Use" was completed in 1986 by R.F. Courtney at the University of Calgary Faculty of Environmental Design, Calgary, Alberta.

Management Challenges

Major challenges in the future are maintaining habitat (especially winter range), maintaining a quality hunting experience, maintaining access to private and leased land, minimizing conflicts between agricultural land use and pronghorn and people land use, and decreasing pronghorn losses during severe winters.

Table 1. Pronghorn antelope population and harvest estimates and preseason (July) sex and age ratios in Alberta from 1967 to 1987.

YEAR	ESTIMATED POPULATION	ESTIMATED HARVEST	PRESEASON SEX/AGE RATIOS	
			BUCKS/100 DOES	FAWNS/100 DOES
1967	10,037	496	47	64
1968	9,660	955	54	80
1969	6,210	Closed	No Data	No Data
1970	11,400	481	59	68
1971	9,424	628	50	60
1972	10,411	665	58	67
1973	10,627	798	47	48
1974	11,115	739	30	55
1975	11,777	1,122	42	53
1976	16,813	1,260	46	75
1977	17,953	1,995	43	58
1978	10,919	674	38	68
1979	15,330	914	38	91
1980	18,637	1,935	44	59
1981	20,707	2,364	45	68
1982	21,202	2,640	47	58
1983	No Data	3,309	No Data	No Data
1984	32,071	6,757	45	56
1985	24,174	3,950	46	54
1986	24,610	4,735	41	63
1987	26,209	7,708	44	62
Mean	15,964	2,206	44	62

ARIZONA STATE REPORT

Ray Lee, Arizona Game and Fish Department, Phoenix

Population Estimates

Arizona's pronghorn antelope population is composed of three species; Antilocapra americana americana, A. a. mexicana, and A. a. sonoriensis. During the survey period, prior to hunt and post-fawning mortality, Arizona's antelope population is approximately 12,100; 11,250 americana, 750 mexicana, and 100 sonoriensis. Pronghorn distribution in Arizona is depicted in Fig. 1. The Game Management Units with the largest populations are units 19B, 5B, 10 and 7; these Units contain nearly 25% of the total population.

Surveys:

Pronghorn in Arizona are surveyed primarily from a fixed-wing aircraft (Piper Super Cub, or STOL Cessna 182 or 206). A total of 7907 americana were surveyed in 1987, resulting in buck; doe; fawn ratios of 31; 100; 31; this is close to the 15-year average of 32; 100; 33 (Fig 2). A total of 504 mexicana were surveyed, resulting in ratios of 58; 100; 28. Sonoriensis are not hunted, being listed as a threatened species, and are not surveyed systematically.

Harvest:

In 1987, 466 antelope were harvested with firearms and 32 by archers. This was down from 565 and 34 in 1986 (Fig 3). Application rates for the three weapon types varies considerably. When archery hunting first began in 1974, 16 hunters applied for the 50 permits available. In 1987, 498 archers applied for 478 permits. Muzzle loader permits were oversubscribed by 358 applicants to 125 permits and the centerfire rifle hunters' subscription rate was 8682 for 647 permits. These application rates led to minor adjustments in the 1988 permit levels to more

accurately allocate permits by demand (Fig 4). Additional 1987 harvest information is shown below:

Weapon	Permits	Hunters	Days Afield	Harvest	% Success
CFR	591	571	1276	426	75
Mzl	123	117	262	40	34
Arch	478	456	2340	32	7

One of the most significant results of Arizona's antelope harvest is in the Boone and Crockett scores. In the last four years, five heads in excess of 90 points have been reported. Unofficially, Arizona has now produced 12 of the top 20 scores.

Management Plans, Strategic Plans, and Guidelines

The Arizona Game and Fish Department provides each of its Wildlife Managers with an Antelope species management plan. This 50 page document gives guidance on how to survey, make hunt recommendations, fence, supplemental feed, etc., their antelope populations. Hunt guidelines are annual guides, reflecting the political climate, for setting season dates and permit numbers. In 1988, season dates will be 8/26 - 9/8 for archers, with stratified seasons for firearms hunters of 9/23 - 9/26 and 9/30 - 10/3. The strategic plans tell where the Department is going in antelope management and identifies hunting strategies. Antelope are managed under basic, alternative, or vulnerable species criteria. The prime criterium is for post-hunt buck to doe ratios. Basic management calls for 25-30:100, with 30-40:100 for alternative, and 35+:100 for vulnerable species. Other criteria deal with hunter density, ranging from 1 permit per square mile to 1/2 per square mile, and percentage of yearly buck recruitment, ranging from 60 to 40%.

Transplants:

Arizona has engaged in a fairly active antelope transplant program since its first release with Nevada antelope in 1924. Recently, Arizona has had the good fortune of having the money and excess bighorn sheep to initiate trades with several western states for pronghorn antelope. Usually, we are doing these states a favor by helping them remove depredating animals; however, we have been "in the market" for the mexicana sub-species to repopulate historic range. Since 1981, Arizona's transplant record is:

Year	Number of Animals and State of Origin
1981	82 - Colorado, 51 - Texas
1982	50 - Utah
1983	
1984	176 - Colorado, 32 - Texas, 81 - Wyoming
1985	
1986	101 - Texas
1987	100 - Texas
TOTAL =	673

Special Studies

A Sonoran pronghorn study has been underway for several years. Primarily, the research is concerned with habitat use, fawning rates, and movement patterns. A total of ten antelope have been fitted with transmitters for this work. The animals were captured using a net-gun (Fig. 5).

A report on the effectiveness of aerial coyote control has been produced. The Department is engaged in an active program to aerially gun transplant sites and units where the fawn crop falls below 20:100 for 2 consecutive years.

Special Permits

The Department is in the business of auctioning or raffling special permits for fund raising purposes. The most successful have been for bighorn sheep ($85,000 for a permit) and elk ($40,000 for a permit). For two years special antelope permits were distributed, resulting in approximately $2,500 per permit. These funds are earmarked for antelope management and have been expended on the antelope transplant program.

PRONGHORN ANTELOPE DISTRIBUTION

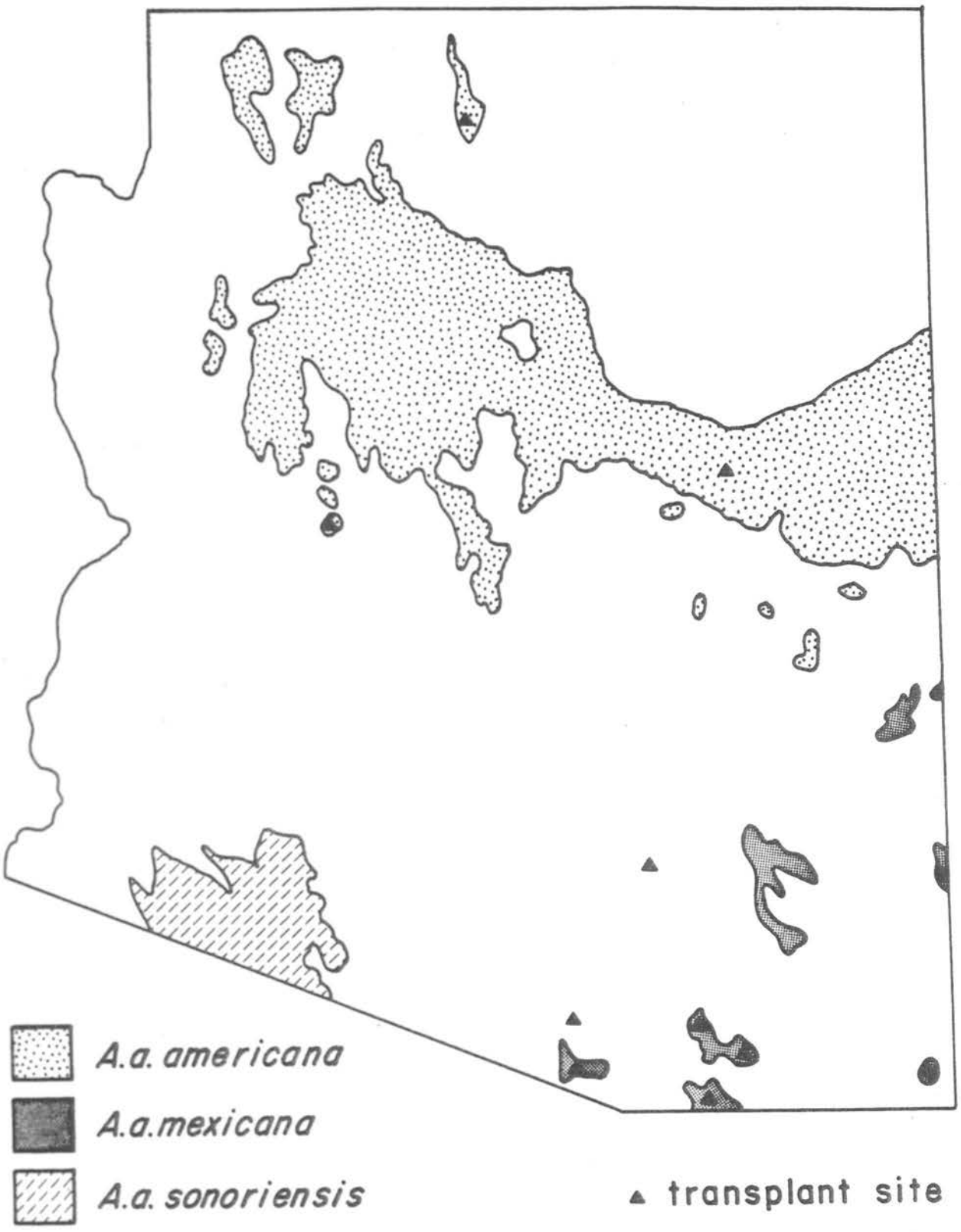


FIGURE 2.

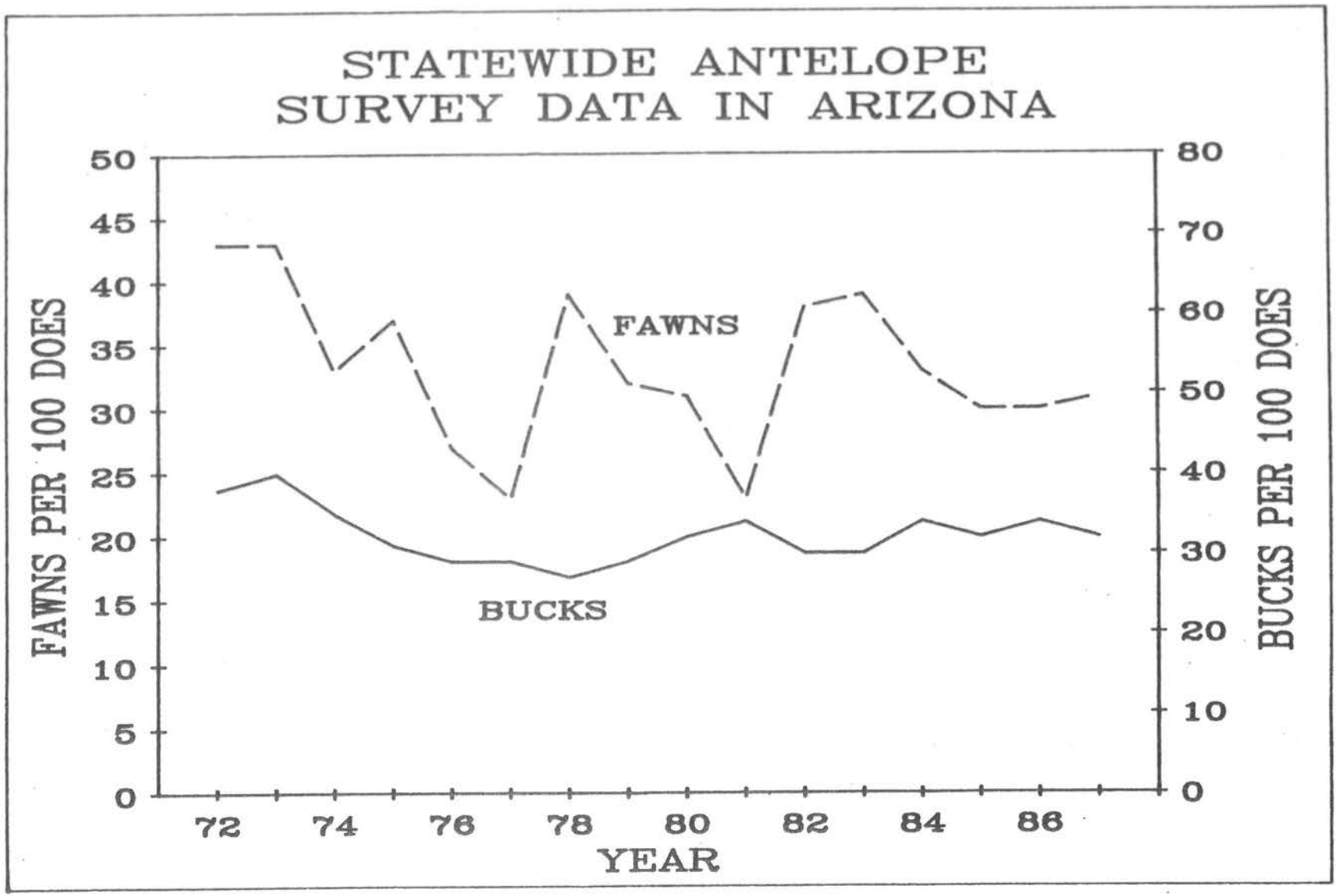

STATEWIDE ANTELOPE
SURVEY DATA IN ARIZONA
FAWNS PER 100 DOES
BUCKS PER 100 DOES
FAWNS
BUCKS
YEAR
0
5
10
15
20
25
30
35
40
45
50
0
10
20
30
40
50
60
70
80
72
74
76
78
80
82
84
86

FIGURE 3.

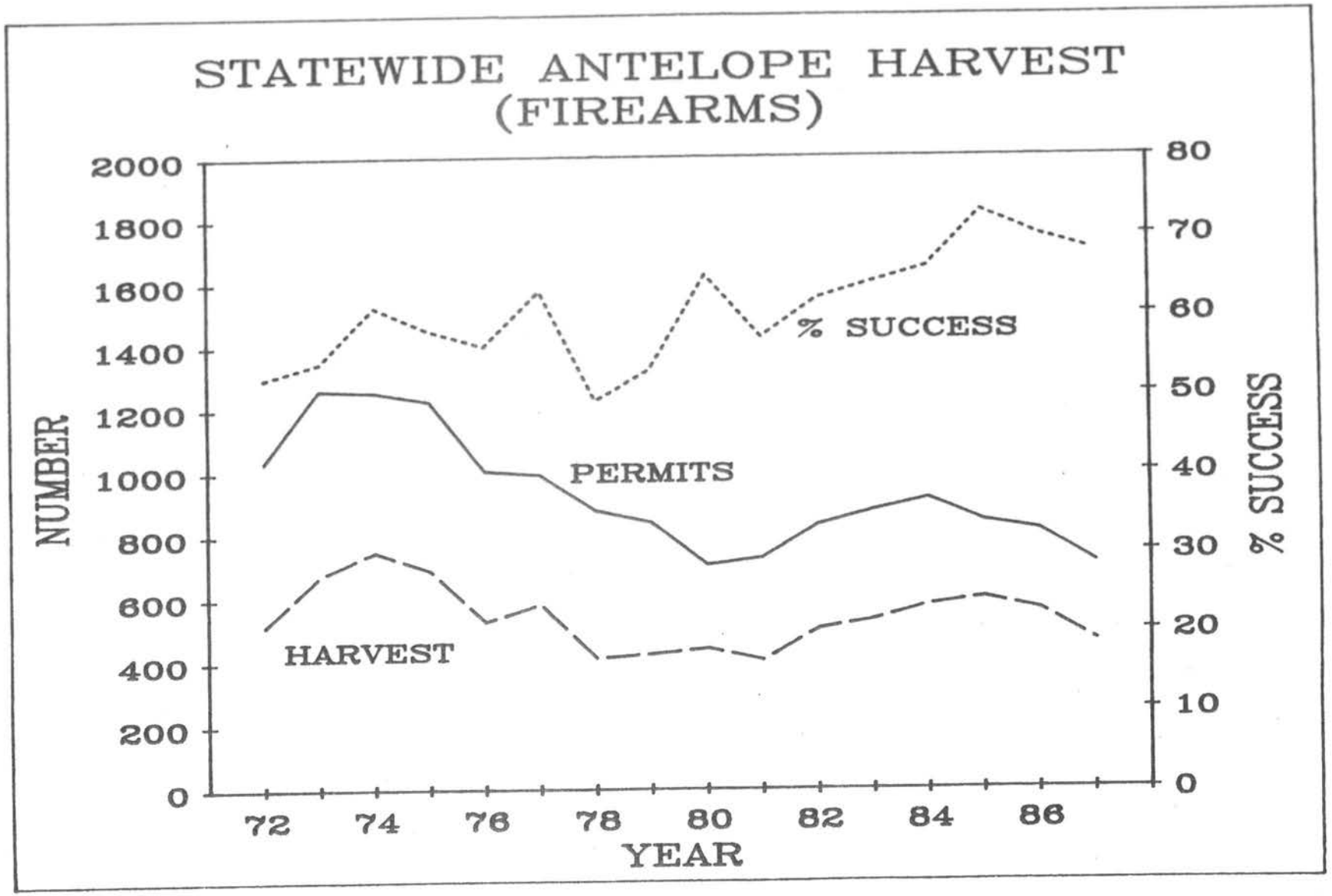
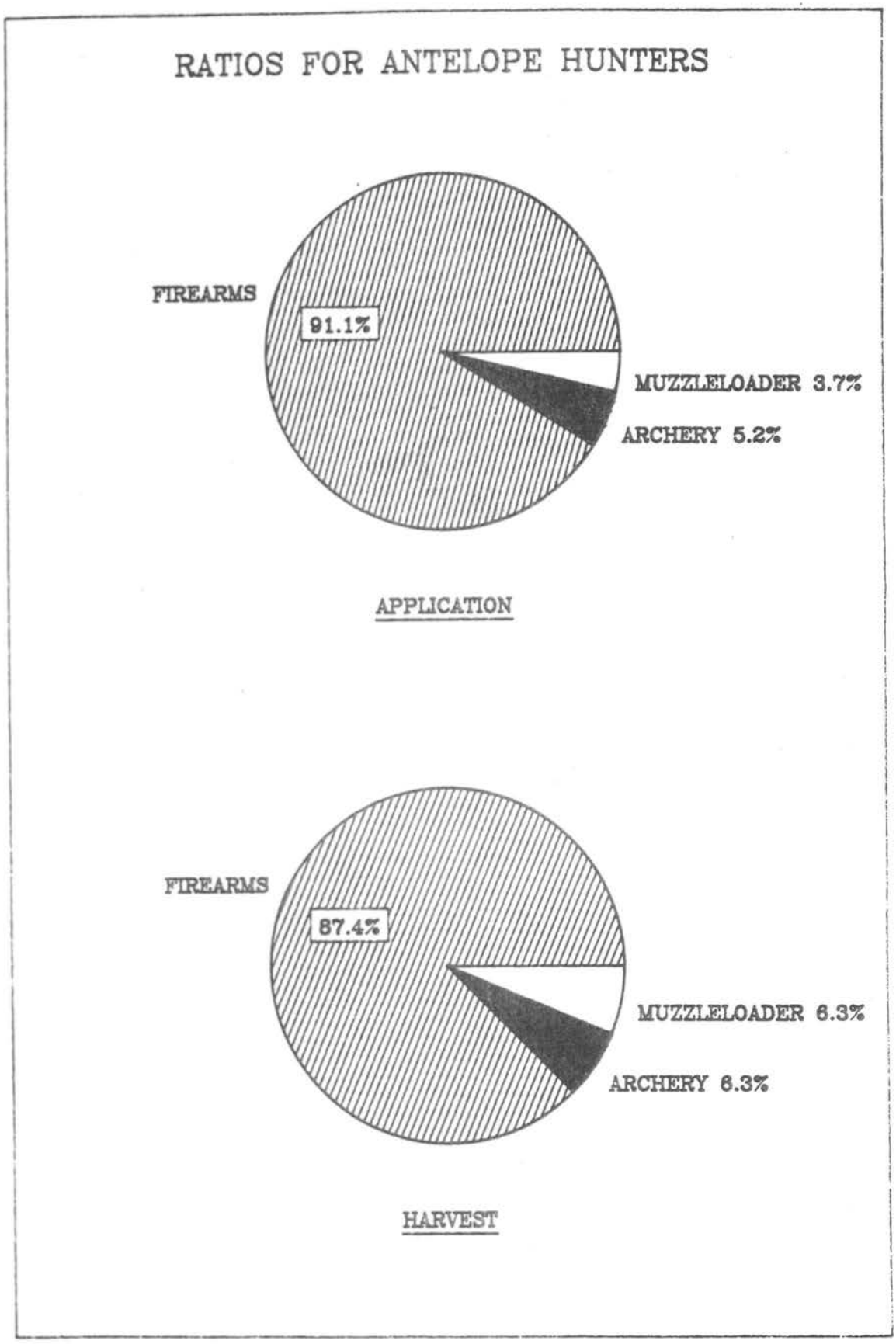

STATEWIDE ANTELOPE HARVEST
(FIREARMS)
NUMBER
2000
1800
1600
1400
1200
1000
800
600
400
200
0
% SUCCESS
80
70
60
50
40
30
20
10
0
% SUCCESS
% SUCCESS
PERMITS
HARVEST
72
74
76
78
80
82
84
86
YEAR

FIGURE 4.


RATIOS FOR ANTELOPE HUNTERS
FIREARMS
91.1%
MUZZLELOADER 3.7%
ARCHERY 5.2%
APPLICATION
FIREARMS
87.4%
MUZZLELOADER 6.3%
ARCHERY 6.3%
HARVEST

CALIFORNIA STATE REPORT

L. "Bud" Pyshora, Department of Fish and Game, Redding

Annual Census

An aerial census is conducted each winter in the six northeastern California herds. In 1988, 7,201 animals were counted. This census has been conducted each year since 1942. This year's total was the second highest ever recorded, exceeded only by the 7,256 counted in 1986. Trapping and transplanting efforts have resulted in small populations in Kern, San Luis Obispo and Mono counties, which are not included in the census total. These populations approximate 400 pronghorn.

Ratios

Aerial herd ratio surveys are conducted annually, normally in July, in northeastern California herds. In 1987, 5,424 animals were classified and a ratio of 30 bucks and 44 kids per 100 does was determined. Both buck and kid ratios are three per 100 does above the previous five-year average.

Harvest

Pronghorn hunting was banned in California from 1883 to 1942. In 1942 a special buck only hunt was approved by the California Legislature. From 1942 to 1964, seven special buck only hunts were held. Since 1964 hunts have been held annually in northeastern California. Bucks in excess of 20 per 100 doe are considered surplus and buck permit quotas are based on this ratio, by herd. If a herd population exceeds its planned population goal, doe permits may be issued. All hunts are special hunts and hunters are chosen by a statewide drawing. There is a high demand for applications. In 1987 over 16,000 applicants applied for the 785 permits available.

In 1987, 775 hunters took 552 pronghorns: 465 bucks including 19 by archery and 87 does. Buck hunter success during rifle seasons has averaged 86 percent during the most recent 10 years. Archery buck hunters have averaged 19

percent and rifle doe hunters 70 percent. Hunters are required to return the mail-in portion of their tag if successful, or both tags if unsuccessful, so kill records are accurate. From 1964 through 1987 hunters reported taking 7,638 pronghorn in northeastern California plus 14 in the Mono County area. Hunts are held during the last weekend of August through the first weekend in September. Archery season is earlier.

In 1988, 745 permits have been requested for: 545 bucks, 100 does and 100 preseason archery bucks. Hunts are limited to California residents.

An orientation session is held on the day prior to the rifle season. All rifle season permittees are invited to attend and about 25 percent do so. Information on hunting techniques, care of animals taken, judging trophies, estimating ranges, caping animals for taxidermy, general location where pronghorn may be found and California's pronghorn management program are subjects covered. This orientation is well received by hunters and others attending.

Range Conditions

The 1987-88 precipitation was below normal resulting in below normal forage conditions. In spite of this the kid survival rate improved slightly compared to recent years.

No range improvement projects were conducted specifically for pronghorn. The expansion of irrigated alfalfa farming into pronghorn range in recent years has improved summer and fall forage conditions in some areas. At present the economics of alfalfa farming have caused some ranchers to cease operations. It is too early to tell if this will adversely affect pronghorn.

Research

Blood samples are routinely collected from pronghorn captured during relocation projects and from hunter-killed animals. These blood samples are tested for evidence of the animal's exposure to various diseases and for selenium levels. Tests show that a large percentage of the animals have been

exposed to blue tongue. No disease losses have been known to occur. Some animals show blood selenium levels well below that known to cause problems with reproduction in cattle and deer. The effects of low selenium levels in pronghorn, however, are apparently not known.

Trapping and Transplanting

Since 1977 we have been live trapping and relocating pronghorn. Emphasis is placed on stocking ranges formerly inhabited by this species but where they no longer occur. In February 1988 we trapped 267 pronghorn and relocated them to five sites in San Benito and San Luis Obispo counties in our central coast areas.

Two of these releases were made to supplement releases made in 1987. The other three sites were initial releases. Preliminary indications are that these releases will result in viable populations in the release areas. Pronghorn are trapped from northeastern California herds where populations exceeded herd goals. Six capture programs have been conducted since 1977 and 730 pronghorn have been relocated.

COLORADO STATE REPORT

Thomas M. Pojar, Colorado Division of Wildlife, Ft. Collins

The estimated number of pronghorns in Colorado pre-hunt 1988 is 56,000. This estimate is based on computerized population simulations of each of 32 pronghorn Data Analysis Units (DAU's) in the state. The population model (POP-II) uses population size estimates or trend counts, herd structure data, and harvest information as the major driving parameters.

During the harvest season of 1987, 7,522 animals were killed for an overall hunter success rate of 68%. The projected harvest for 1988 is 9,000 based on the issuance of 12,000 permits and assuming a success rate of 75%. Projected post-hunt population size in 1988 is 47,000 animals and the long-term objective is to increase the population by 10%.

A unique situation exists in northwestern Colorado where archery hunters hunt from blinds near water sources and have an exceptionally high success rate. This has necessitated the use of limited archery permits for this area. The archery hunters in this area had a success rate that was 58% in 1987 compared to an average of 16% for the remainder of the state. Archery hunters killed 179 pronghorns in the northwest part of the state where licenses are limited and only 93 in all of the remainder of the state where licenses are not limited. Overall, 272 animals were taken by archery hunters which represents only 3.6% of the total state harvest.

Of the total of 104,247 square miles in Colorado, approximately 58,756 (56.4%) are potentially habitable by pronghorns. The habitable area is divided into 32 DAU's for management purposes and represent 5 different habitat types as described by Erickson and Smith 1985 (Atlas of Colorado. Colo. Assoc. Univ. Press, 73 pp). For purposes of comparison of pronghorn density and productivity, the DAU's were categorized by habitat type (Table 1). The comparison is not precise because not all of the area in a DAU is pronghorn habitat and because a DAU was placed in a certain habitat type category if more than half of the area was that type. Therefore, the figures in Table 1 should be viewed for their relative comparison rather than for their absolute values.

The grassland plains (GL/Plains) habitat is found in the eastern third of the state and approximately 40-50% of this area is under some form of agricultural tillage thus altering it from native short grass prairie. Reproduction, as measured by late summer fawn to 100 does ratio, is highly variable from year to year and from herd to herd. Winters are laced with short periods of extremely severe weather with snow and high winds, however it is uncommon for snow depth to limit movement and foraging.

The woodlands/lower mountains (WL/Lo mts) type is found mostly along the front range and is quite diverse vegetatively. Pronghorns are found in small parks and ridges that have shrubby growth, usually with sagebrush as a significant component. Only 2 herds inhabit this type and their reproductive rates seem to remain consistently in the 50's.

Grassland sage (GL/Sage) type is found in the large high mountain parks and is subject to frequent severe winters. Reproductive rates are quite variable which may be due to the effects of limited foraging conditions during severe winters.

The sagebrush plateau (Sage/Plat), in the northwest, is only a small portion of the overall pronghorn range but it is easily the most productive and densely populated pronghorn area in the state. Reproductive rates are consistently high (70's and 80's). There is persistent and effective predator (coyote) control practiced throughout the area which <u>may</u> contribute to successful pronghorn recruitment.

The desert shrub type (Desert/Shr) is found in extreme western Colorado and is characterized by drought-resistant shrubs and brush. Pronghorn populations in this type have typically low recruitment and/or high predation which result in small, stagnant herds that seem to continually flirt with extinction. Even supplemental transplants into the area do little to embellish the thrift of the population. Late summer fawn:100 doe ratios are commonly in the low to mid 30's with occasional years of higher reproduction.

Table 1. Colorado pronghorn status by habitat type. Population figures for post-hunt 1987.

Hab. Type	No. DAU's	Area		Population		Density	Fawn:Doe	
		Mi^2	%	Total	%		X^1	Range
GL/Plains	12	32,048	54.5	28,250	60.0	.88	71	32-89
WL/Lo mts	2	5,148	8.8	1,090	2.3	.21	57	56-59
GL/Sage	11	12,678	21.6	6,405	13.5	.51	57	37-75
Sage/Plat	2	2,250	3.8	8,570	18.1	3.81	78	71-79
Desert/Shr	5	6,632	11.3	2,995	6.3	.45	59	33-65
Totals	32	58,756		47,310		.81	69	33-89

[1] Weighted mean on population size.

IDAHO STATE REPORT

Lloyd E. Oldenburg, State Wildlife Manager, Idaho Department of Fish and Game, Boise

Pronghorn numbers in Idaho have generally increased during the past two years. This is partly due to very mild winters. The most severe impact the last two years has been from loss of habitat from fires, which have destroyed several hundred thousand acres in south central Idaho. These losses are cumulative with the loss of over 200,000 acres in the same area of the state the previous two years.

Statewide herd composition counts have not been made in recent years. However, in several units in east Idaho the ratios remained unchanged from a previous ten year mean. In one unit (Birch Creek) the 1973-86 mean was 69 fawns/100 does. In 1986 the ratio was 43 fawns per 100 females; we have no speculation for this change. From 1978 to 1980 the observed ratio in this unit was 95, 93, and 91 fawns per 100 females. The ratio in 1986 was 47:100. The Medicine Lodge unit next to this unit had a 1974-86 mean ratio of 81 fawns/100 females. There were 96 fawns per 100 females observed during 1986 surveys.

Depredation complaints continue to escalate across southern Idaho with as many as 800 antelope being observed in agricultural areas near the Snake River near Twin Falls. This is probably due to a major winter range being burned and the animals being displaced.

The opening date of hunting season was changed from late September to early October in 1983 to delay hunting disturbance until after the rut. There has been no documentation of reproductive change in most units since that time. A change in condition of females going into the winter has been documented. There is now pressure to change the opening of the hunting season back to late September to allow people who get an antelope permit to take part in both the antelope hunt and the opening of early October elk hunts. A decision has been delayed until the 1991-95 Antelope Species Plans are written.

An early archery depredation hunt is maintained in 18 management units from August 6-26. These hunts are open within one mile of any agricultural crop on private land. A general archery antelope season opens August 27 and ends September 11 this year in 19 management units. There were 408 antelope archery hunters in 1987.

There were 3,071 controlled hunt permits issued in 1987 and 2,364 antelope were harvested for 77 percent hunter success. These hunters hunted an average of 2.1 days each, and they observed an average of 74 animals per day each. Seventy-two percent of the harvest was male animals. There has been a two year waiting period for anyone who drew an antelope permit for many years. In 1987 this was changed to a one year waiting period. In 1986 there were 4,670 applicants for 3,230 permits (a 1:1.45 odds of drawing a permit). There were 5,311 first choice applicants for the 3,071 permits in 1987. The drawing odds were 1:1.7. The result of reducing the waiting period was not large and in 1988 the waiting period was eliminated. In addition, in 1987 the department began to publish drawing odds for each hunt.

Thirteen of 46 controlled hunts had a segment of the hunt when only doe or fawn was legal. Three depredation hunts were for doe or fawn only. There are four scheduled for 1988.

KANSAS STATE REPORT

Terry L. Funk, Kansas Department of Wildlife and Parks, Hays

1987 PRODUCTION REPORT

The bulk of this report deals with the major herd in northwest Kansas located in parts of Wallace, Sherman, Logan, and Thomas counties. Other small herds have existed in Comanche and Barber counties for some years, and two additional herds were established during the winter of 1978-1979; three additional herds were established during the winter of 1979-1980 in Gove, Ellsworth, and Morton counties. The Chase and Ellsworth county releases have not shown any growth and are now considered unsuccessful.

An aerial survey to classify pronghorns was conducted August 11, 1987, in Wallace and Sherman county west of Kansas highway K-27. A Cessna 206 aircraft was used, flying north-south transects at one half mile intervals.

Aerial surveillance accounted for 235 pronghorn antelope. A total of 232 pronghorn antelope was classified according to sex and age compare to 244 in 1986. The herd sex and age classification is based on the total animals classified. The buck:doe:fawn ratio for 1987 was 47:100:79 (Table 1), compare to 32:100:68 for 1986.

Table 1. Kansas Pronghorn Antelope Herd Sex and Age Composition, 1986-1987

Bucks		Does		Fawns		Total		Bucks:Does:Fawns	
1986	1987	1986	1987	1986	1987	1986	1987	1986	1987
39	48	122	103	83	81	244	232	32:100:68	47:100:79

The percent of fawns was 34.9% compare with 33.2% in 1986 and the past three year average of 32.3%. Bucks accounted for 20.7% of the classified antelope and does accounted for 44.4% (Figure 1). There were 79 fawns and 47 bucks for every 100 does in 1986.

1987 WINTER SURVEY

Aerial surveys were conducted February 24 and 25, 1988 to obtain winter population data. Surveys flown over the major range in Sherman, Wallace, and Logan counties accounted for 891 antelope (Figure 2). This represents a 5.8% increase over last year. This year's average herd size was 11, while in 1986 it was 24. A herd of 50 was observed this year with 50 being the largest herd in 1986.

EVALUATION of HARVEST TRENDS

Antelope hunters (Firearms and Archery) harvested a total of 224 animals (168 bucks and 56 does) during the 1987 seasons. Three hundred and five hunters (Table 2) actually went afield.

ARCHERY SEASON

The twelfth archery pronghorn season was held, September 28 - October 4, 1987. Archery hunting was open in all, or parts of 14 counties. A total of 62 applications were received for the 150 available permits. Questionnaires mailed with the permits were utilized to obtain archery season data. A 87.1% response was obtained.

Of the 62 permittee, 51 archers actually went afield (Table 2). Archers harvested 8 pronghorns (5 bucks and 3 doe) for a hunter success of 15.7%. The 1987 archery season provided 191 mandays (Table 3) of recreation (3.8 days/archer). Archery hunters in 1986 harvested 4 pronghorns (3 bucks and 1 doe) for a hunter success of 7.0%. The 1986 season provided 3.6 days/archer or 207 mandays of recreation.

FIREARMS SEASON

The firearms antelope season was held October 10 - 12, 1987. Of the 266 permits allowed, in six management units, 123 went to landowners and 143 to general residents; all had to be legal residents of Kansas. Questionnaires mailed with the permits were used to obtain harvest data. A 97.7% response was obtained by using one follow-up mailing.

Of the 266 permittee, 254 hunters (Table 2) actually went afield. These sportsmen spent 362 mandays (1.4 days/hunter) hunting and harvested 216 antelope (85.0% success).

Essentially, the pronghorn season was a one-day affair. Opening day accounted for 67.6% of the harvest and 61.6% of the hunting pressure; this compare to 55.7% and 58.5%, respectively, in 1986. Forty-nine antelope were taken the

second day, and 21 were harvested the last day of the season. Of the 216 harvested antelope, 163 were bucks and, 53 were does.

Table 2. ANTELOPE HARVEST by SEASON and HUNT UNIT

UNIT #	SEASON	ACTIVE HUNTERS	SUCCESSFUL HUNTERS	BUCKS HARVESTED	DOES HARVESTED	% SUCCESS OF ACTIVE HUNTERS	MAN DAYS
1	FIREARMS	79	69	53	16	87.34	104
2	FIREARMS	95	89	65	24	93.68	128
3	FIREARMS	39	33	23	10	84.62	56
4	FIREARMS	19	11	8	3	57.89	32
5	FIREARMS	6	4	4	0	66.67	13
6	FIREARMS	16	10	10	0	62.50	29
SUBTOTAL		254	216	163	53	85.04	362
7	ARCHERY	51	8	5	3	15.69	191
TOTAL		305	224	168	56		553

TABLE 3. ARCHERY and FIREARMS, ANTELOPE HARVEST SUMMARY

YEAR	DATES OPEN	DAYS	APPLICATIONS RECEIVED	PERMITS AVAILABLE	ACTIVE HUNTERS	MAN DAYS	HARVEST	% SUCCESS
				ARCHERY				
1976	SEPT.25-29	5	54	50	42	131	7	16.7
1977	OCT. 1-5	5	59	60	52	182	4	7.7
1978	SEPT.30-OCT. 4	5	87	60	50	148	4	8.0
1979	SEPT.29-OCT. 3	5	86	80	73	211	2	2.7
1980	SEPT.27-OCT. 1	5	60	80	51	163	10	19.6
1981	SEPT.26-30	5	95	100	86	270	12	13.9
1982	SEPT.25-29	9	74	100	69	233	11	15.9
1983	SEPT.17-25	9	142	150	127	487	18	14.2
1984	SEPT.8-23	16	144	150	116	574	12	10.2
1985	SEPT.28-OCT. 6	9	99	150	84	274	6	7.1
1986	SEPT.27-OCT. 5	9	75	150	57	207	4	7.0
1987	SEPT.28-OCT. 4	9	62	150	51	191	8	15.7
				FIREARMS				
1974	SEPT.28-30	3	492	80	72	82	70	97.2
1975	SEPT.27-29	3	288	80	78	88	76	97.4
1976	OCT. 1-3	3	524	80	77	91	72	95.5
1977	OCT. 8-10	3	501	100	96	106	91	94.8
1978	OCT. 7-9	3	596	100	97	111	90	92.8
1979	OCT. 6-8	3	688	100	94	100	91	96.8
1980	OCT. 4-6	3	749	160	148	170	142	95.9
1981	OCT. 3-5	3	853	190	180	314	169	93.9
1982	OCT. 2-4	3	838	190	181	454	171	94.5
1983	OCT. 1-3	3	984	390	362	430	321	88.7
1984	SEPT.29-OCT. 1	3	960	420	390	508	337	86.4
1985	OCT. 12-14	3	874	270	250	337	208	83.2
1986	OCT. 11-13	3	813	248	223	328	192	86.1
1987	OCT. 10-12	3	999	266	254	362	216	85.0

Figure 1.

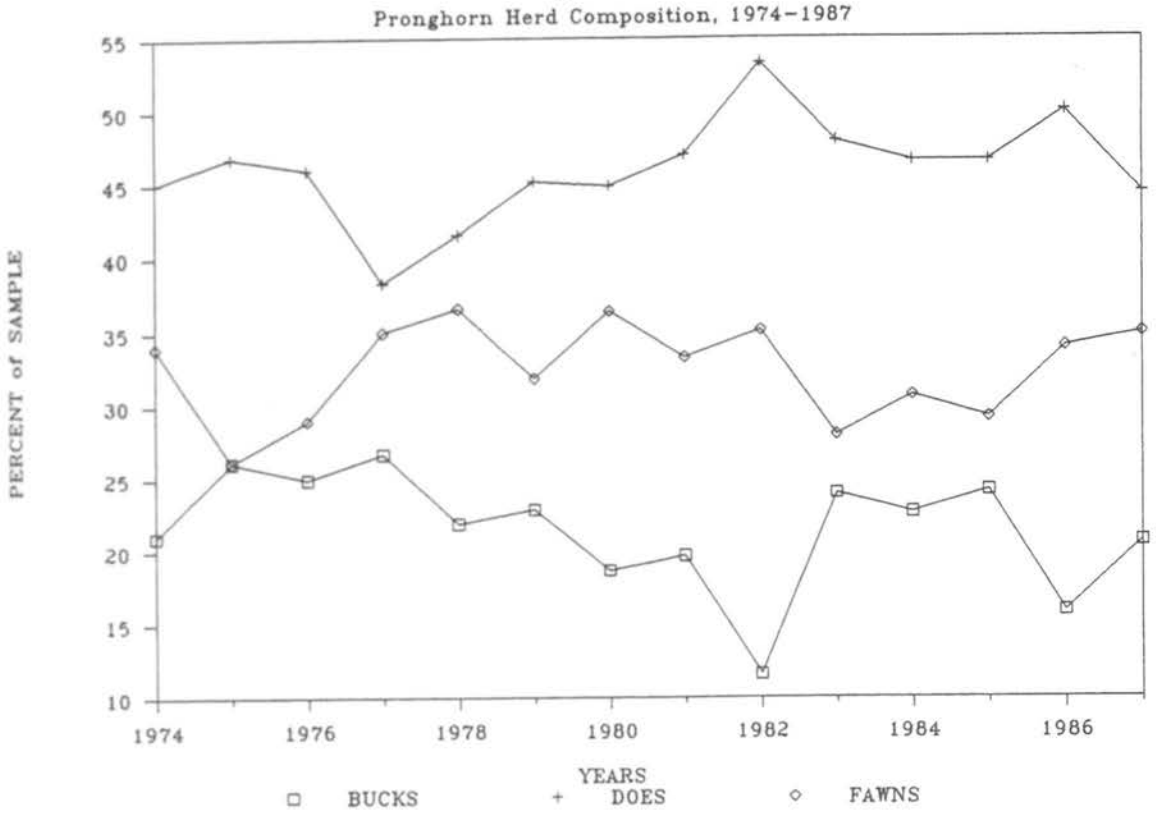
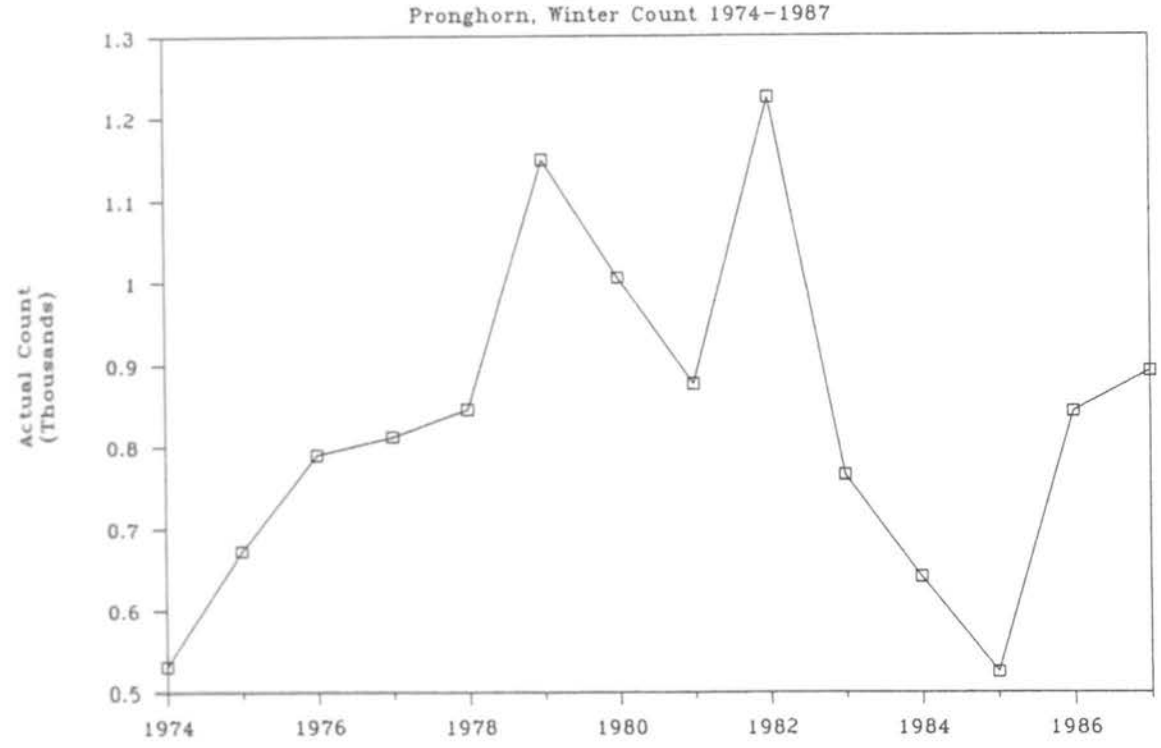


Figure 2.



MONTANA STATE REPORT

Gary Hammond, Montana Department of Fish, Wildlife and Parks, Glendive

Antelope populations have reached a dynamic high plateau as a result of weather conditions which have generally produced habitat conditions favorable to sustain populations at these high levels. The most recent two years have been ideal for antelope, with a combination of normal or above normal spring, summer and fall precipitation and very mild, open winters.

An increasingly liberal season has been implemented, and centered on the doe/fawn segment of the population, in an effort to keep these populations stimulated and productive.

Generally, the years of 1986 and 1987 found production and recruitment up over 1984 and 1985. To illustrate, our best habitats produced up to 130 fawns/100 adult females, and recruited up to 71% of the fawns noted in the summer survey and surviving to a second survey period (at about 15 months of age). By contrast, lower quality habitats produced relative highs for those habitats of 65 fawns/100 adult females.

Trends in population size and composition are determined by total coverage surveys of either selected counting units, trend areas, or entire hunting districts, with budgetary constraints being considered as well. Each area has been sampled at least once every three years on a rotation basis, and more often if the area in question is of high priority, and if budgets allow. Regions 6 and 7 have evaluated sample areas within a hunting unit as to their effectiveness in approximating the entire hunting unit. Both regions currently use that method to obtain population information.

Harvests have increased statewide concurrent with these population increases. In 1986, a total of 42,631 permits were issued, with 35,528 hunters harvesting 36,470 antelope. By contrast, in 1987 46,525 permits were issued, with 39,109 hunters harvesting 39,283 antelope. Antelope hunters averaged 2.6 and 2.7 days of hunting per animal harvested in 1986 and 1987, respectively.

In Montana, nonresidents may be issued up to 10% of available licenses, with 15% of the total licenses in any hunting district being reserved for landowners.

In 1987, the cost of resident and nonresident antelope tags was $8 and $100, respectively, with resident and nonresident doe/fawn tags costing $6 and $25, respectively.

As in the recent past, antelope gun seasons opened the 2nd weekend in October and ran for approximately 4 weeks (October 11 - November 8). In administrative region 7, where the bulk of Montana's antelope are harvested, unlimited doe/fawn tags were valid from October 11 - November 29, to allow hunters the opportunity to shoot does and fawns while hunting deer during the general gun season. Archers can apply for a general antelope license and hunt during an early archery season which ran from September 5 - October 10. A multi-district archery tag was also available in selected regions.

A research effort was initiated in 1986 to ascertain the efficiency of the July-August antelope survey. The impetus for this study came from summer and fall flight data comparisons, which revealed that we were significantly underestimating antelope populations in our mid-summer survey. A summarization of that effort has produced the following details: 1) we are observing only about 50% of the antelope present; and 2) we are re-observing about 25% of the antelope present. Therefore, our existing survey efforts result in a 75% error.

NEBRASKA STATE REPORT

Karl Menzel, Nebraska Game and Parks, Bassett

Antelope populations in Nebraska are currently at the lowest level since the late 1950's and, considering differences in areas covered, may be lower than during any year since aerial surveys were started in 1955. The 1987 estimate from counts was 3,000, with possibly 4,000 as a statewide population. Highs for the same areas surveyed include about 8,100 in 1974 and 7,700 in 1982, with approximately 10,000 statewide in 1974 and 8,700 in 1982.

The single most important event was severe weather during the winter of 1978-79, which caused mortality ranging from about 10% in parts of the Panhandle to nearly 100% of individual herds in parts of Sandhills. Two of the four units for which we have long-term data (Box Butte and Garden) have shown a nearly steady decline since that time, with latest estimates only 14% of the numbers present in 1978. The Box Butte is perhaps the easiest to explain - with some fluctuations, numbers were maintained or increased while fawn:doe ratios were higher than 40:100, whereas the continued decline has coincided with lower fawn crops.

Fawn:doe ratios have also shown declines in other units but with much less consistency. Fawns:100 does by the four 5 year periods from 1967 to 1986 were as follows: Banner - 60,55,53,41; Box Butte - 51,44,33,32; Garden 53,46,51,45; and North Sioux - 80,74,71,72.

No studies have been conducted to determine cause(s) of lowered production, and considering the low densities of antelope involved such studies would be difficult except in possibly the North Sioux. Based on size of survey areas, densities of does/100 square miles in 1987 were about 33 in Banner, 8 in Box Butte, 5 in Garden, and 102 in North Sioux. Predation is the most logical explanation, with coyotes the primary suspect and golden eagles a distant second.

Hunting has been severely curtailed, with only two of a former 10 units open in 1987 and 1988, and only 100 permits allotted this year. Near closure to

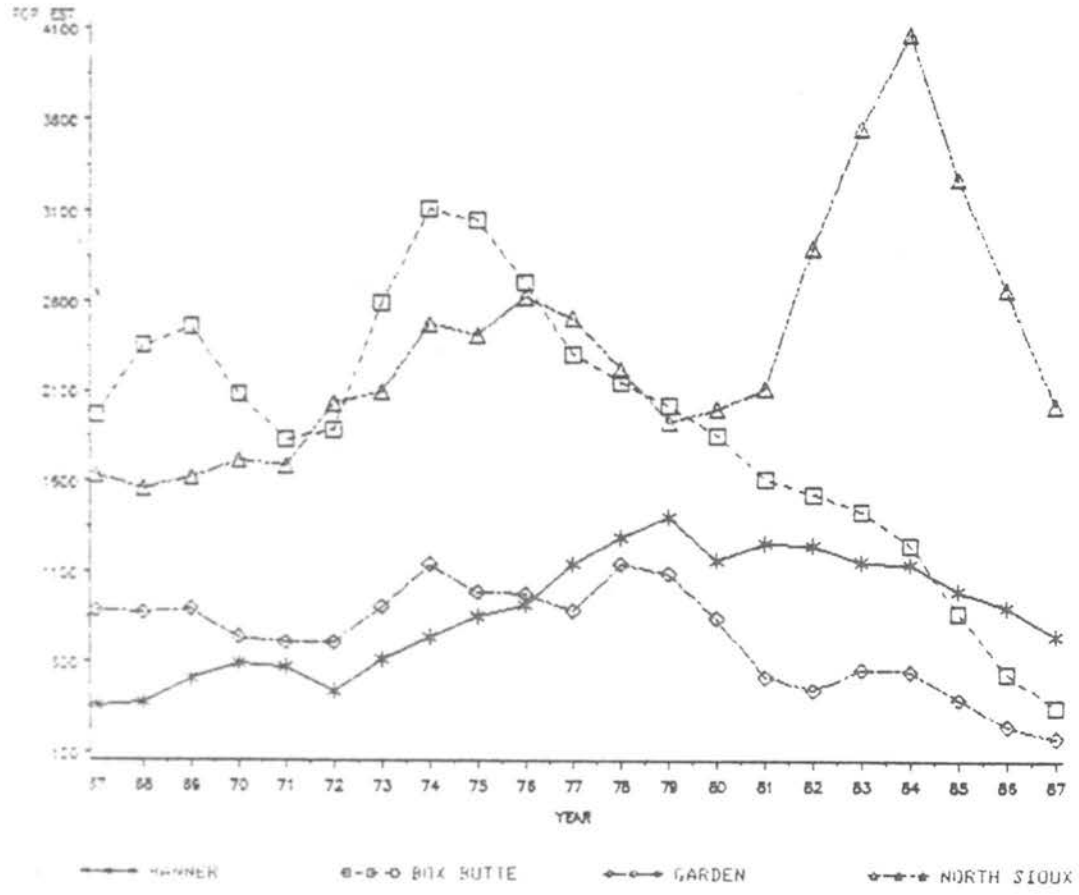
closure of the North Sioux can probably not be justified on a biological basis alone, and it is unlikely that closure alone will restore numbers in the other areas.

Nebraska antelope population estimates and harvest, 1967 to 1987.

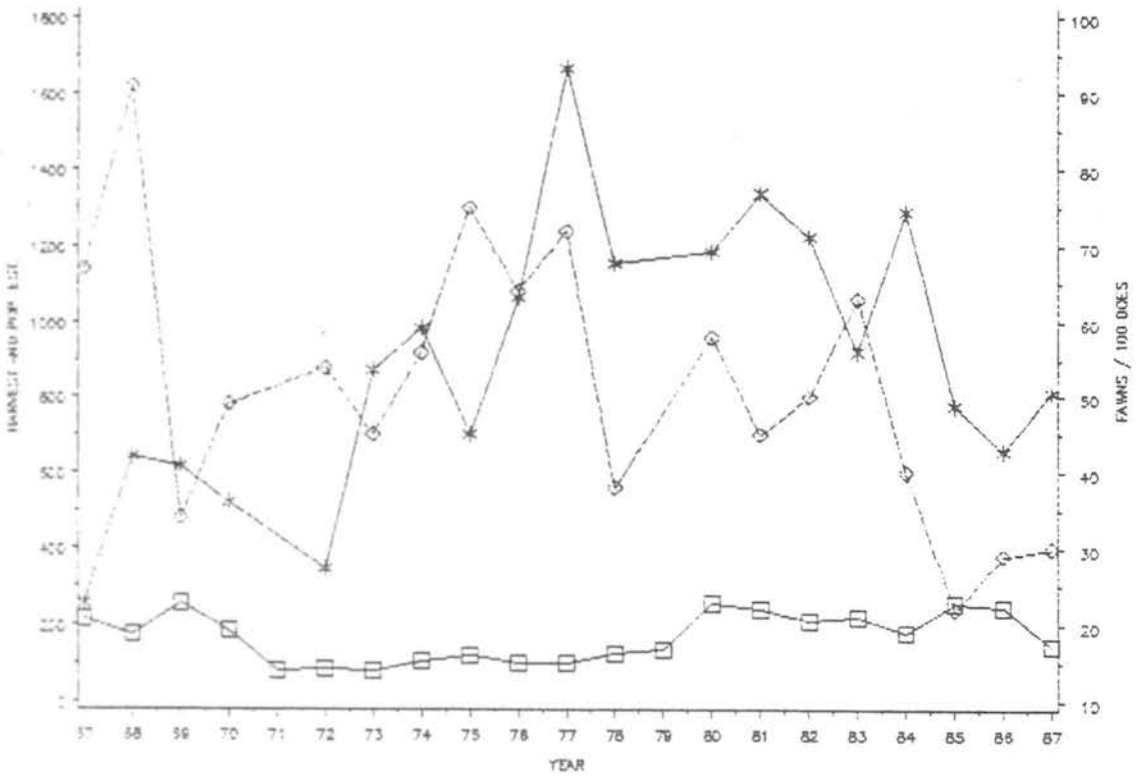
Year	Banner			Box Butte			Garden			North Sioux		
	No.	F:100F	Kill	No.	F:100F	Kill	No.	F.100F	Kill	No.	F:100F	Kill
1967	256	67	218	2312	66	307	1152	55	120	1836	80	413
1968	642	91	175	2424	65	317	762	70	127	1382	81	426
1969	616	34	258	2644	47	326	736	58	127	1664	89	399
1970	520	49	188	1184	43	380	684	36	165	2100	78	375
1971	No survey		79	1680	54	197	690	44	85	1312	73	340
1972	348	54	85	2800	63	207	1074	52	90	2696	84	169
1973	872	45	81	3272	45	286	942	48	112	2288	66	367
1974	984	56	105	3240	42	413	1404	35	120	2436	71	348
1975	704	75	122	2616	37	481	618	50	133	2512	75	449
1976	1064	64	100	2240	34	318	918	45	159	2904	74	494
1977	1664	72	100	2060	36	286	1110	65	148	2088	71	504
1978	1152	38	125	2152	36	214	1398	66	162	1684	80	334
1979	No survey		137	1848	31	73	768	36	74	2024	64	221
1980	1184	58	258	1576	36	114	348	41	86	2280	75	211
1981	1336	45	242	1412	28	97	450	46	50	2036	67	253
1982	1224	50	209	1608	36	79	546	57	51	4364	82	277
1983	920	63	223	1300	35	81	696	42	53	4236	86	365
1984	1288	40	183	852	21	88	420	45	53	3572	64	440
1985	776	22	257	472	31	50	78	29	80	1872	56	407
1986	656	29	245	296	39	54	240	50	37	2520	70	249
1987	812	30*	145	288	37	0	221	30*	0	1676	97	266

*Data not specific to units - pooled information.

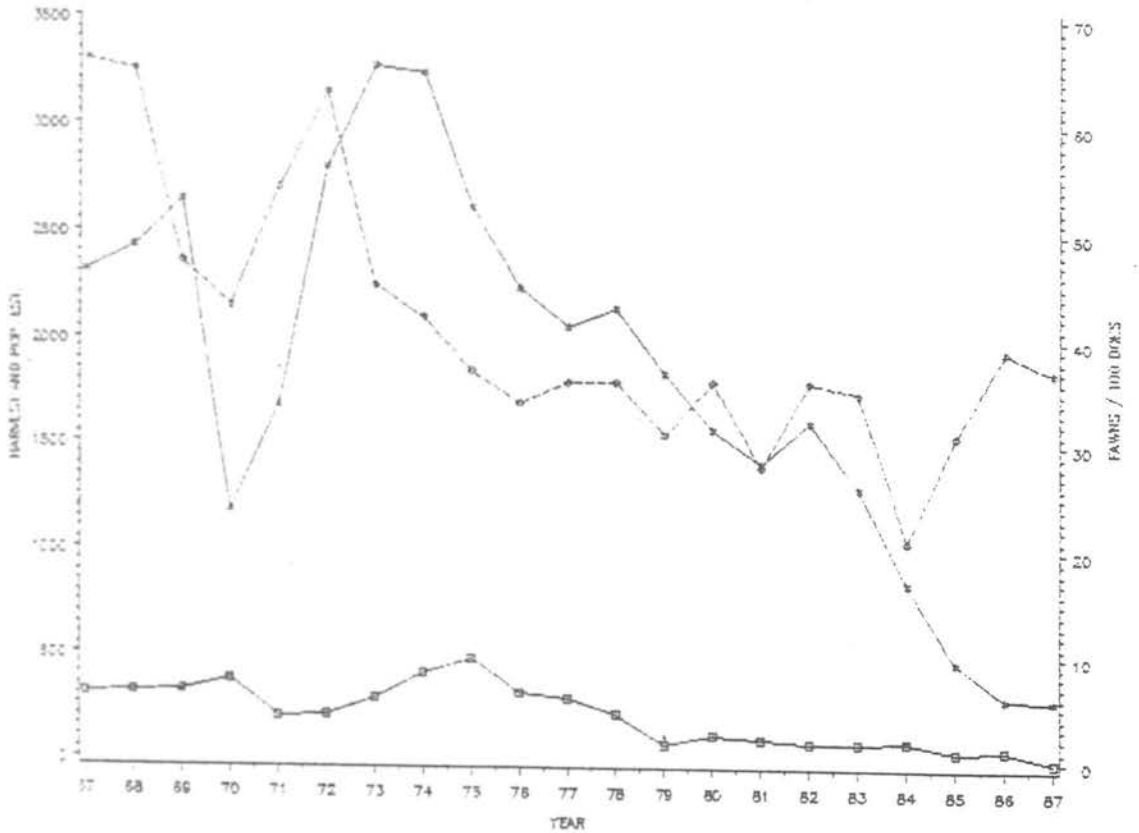
THREE YEAR RUNNING AVERAGE NEBRASKA ANTELOPE UNITS



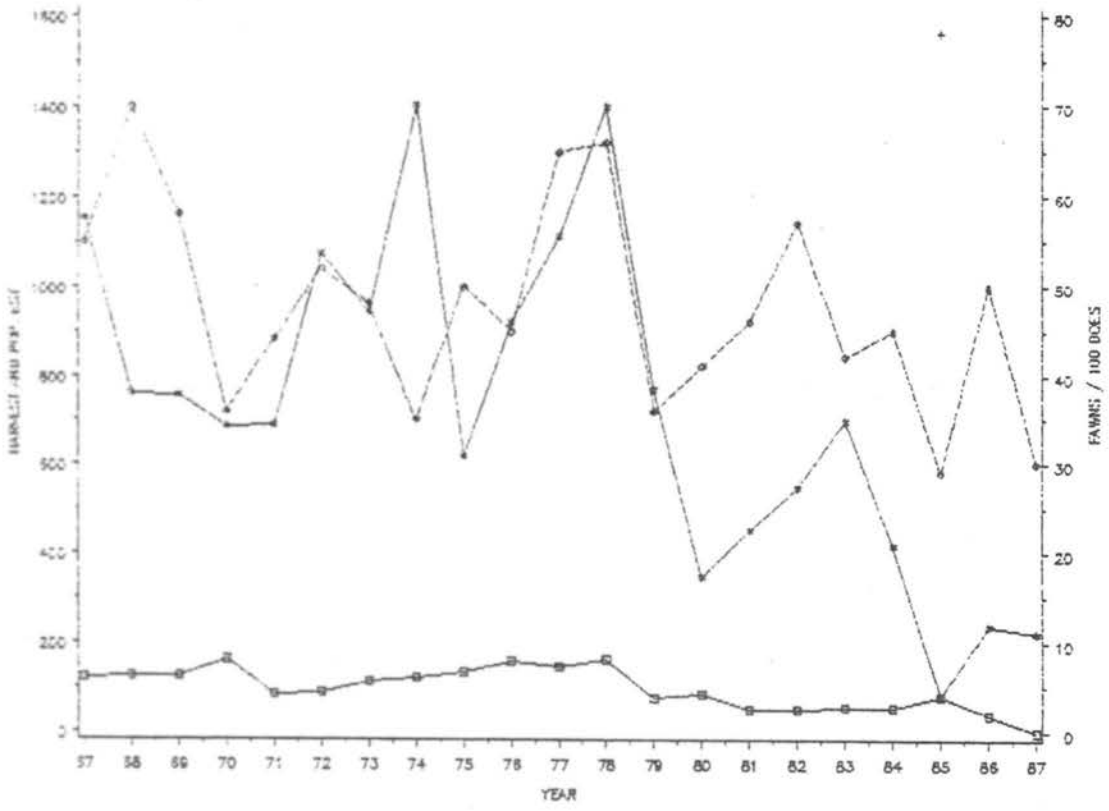
BANNER ANTELOPE UNIT



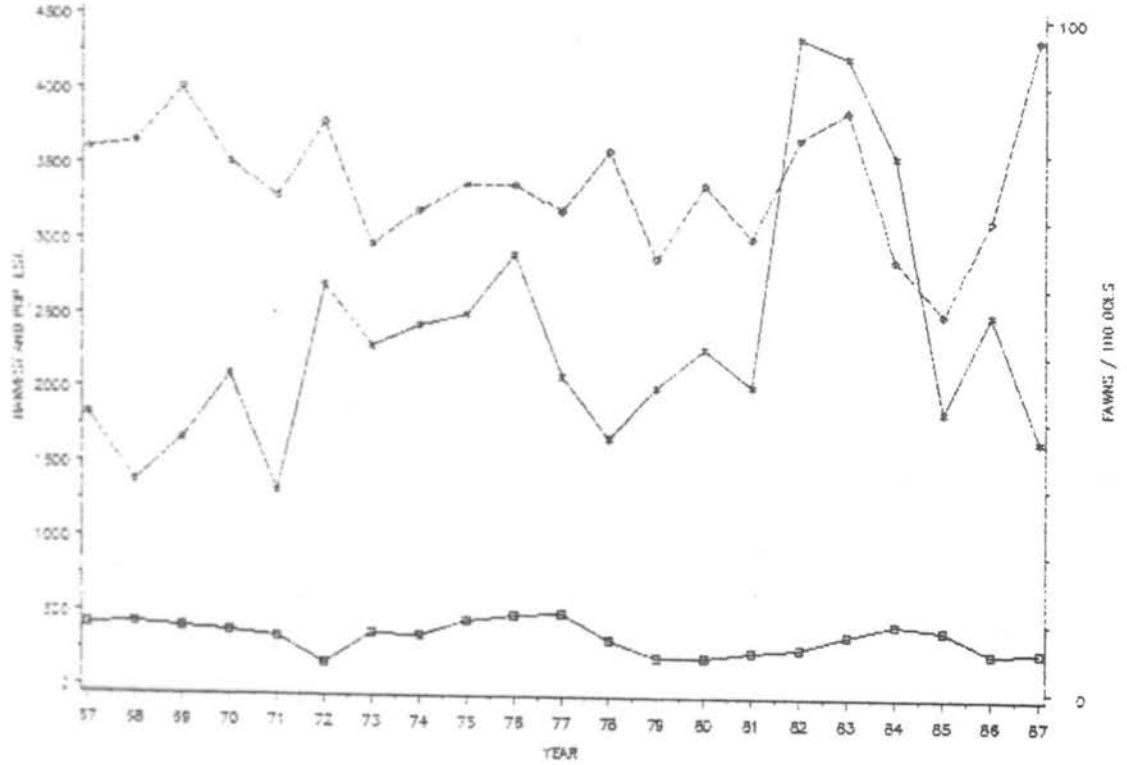
BOX BUTTE ANTELOPE UNIT



GARDEN ANTELOPE UNIT



NORTH SIOUX ANTELOPE UNIT



* = POP. EST ◇ = FAWNS / 100 DOES □ = HARVEST

NEVADA STATE REPORT

Michael P. Dobel, Nevada Department of Wildlife, Reno

Harvest

A total of 839 rifle tags were available during the 1987 season. Mandatory return card information indicates 764 participating resident hunters reported harvesting 650 antelope for an 85 percent success rate. Thirty-six nonresident rifle hunters reported harvesting 34 bucks for 94 percent success rate. Resident hunters reported spending an average of 2.5 days in the field while nonresidents averaged 2.6 days in the field. A total of 192 resident archery tags and eight nonresident tags were available during the 1987 season. One-hundred sixty-four participating resident archers reported harvesting 35 bucks for a 21 percent success rate. Five nonresident archers harvested three antelope for a 60 percent success rate.

Herd Composition

Aerial summer antelope surveys in Nevada resulted in 7,759 antelope being classified. This figure represents a 25.3 percent increase over the 6,191 antelope classified during 1986. Composition ratios were observed at 36.7 bucks/100 does/43.9 fawns which compares to 37.9 bucks/100 does/42.5 fawns during the 1986 survey. Observed buck ratios during these summer flights continue to remain high even with increased tag quotas. Fawn ratios continue to remain low but appear to be adequate for population growth.

Population Trends

Nevada antelope populations have exhibited a general growth pattern for the last 35 years. Department biologists classified 7,759 antelope during summer surveys in 1987, the highest number ever recorded. This total is twice that encountered 10 years ago, 3.6 times that recorded 20 years ago and over six times the number counted 30 years ago when Nevada antelope populations were at low levels. Recorded counts were made in portions of Washoe, Elko, White Pine and Lincoln Counties, indicating that the continued population growth is a general phenomenon.

Research and Management

During January, 1988, approximately 190 antelope were trapped in northwest Nevada near Gerlach using a helicopter and corral trap. These antelope were used to augment existing populations and for reintro- ductions into historic range in central and northeast Nevada.

Currently there is no ongoing research on antelope in Nevada.

NEW MEXICO STATE REPORT

Antelope populations in New Mexico are primarliy in the eastern plains. They also occur in less abundance on the western side of the state. The 1984 estimated population was 30,000. Antelope productivity has increased since then because of favorable weather and forage conditions.

There are 69 antelope flight units that have been in a three-year rotation system of 100 or 33 percent population counts in April. Fawn productivity flights are conducted in July in selected units to determine population trends or recruitment problems. We will evaluate a plan to fly only in August or September for a population count and buck:doe:fawn ratios. This method may permit us to survey more units more frequently.

There were nine antelope hunts in 1986: three archery, one muzzle-loader, four with any legal weapon and one in which only physically handicapped hunters may hunt. Harvest data were collected by a 100 percent mail questionnaire of 5366 licensed hunters. A return sample of 47 percent projected a harvest of 4122 antelope with an 80 percent success rate in 8,139 hunter days. The nine year trend of increasing number of hunters and harvest continues. There was a 250 percent increase in hunters and 291 percent increase in harvest from 1978 to 1986. Our harvest strategy is to provide as much hunting opportunity as possible without negligibly impacting the herds. The increasing antelope population, number of hunters, harvest and success rate indicate that this strategy is working. We have reduced or stopped hunting in several sub-units because of lowered populations due to low fawn recruitment rates.

The Bureau of Land Management and the Game Department have a Cooperative Agreement to transplant antelope in historical range on BLM land where populations have been extirpated. Criteria established by the Roswell BLM antelope study are used to evaluate habitat and modify ranching operations to enhance transplant success. Most recently, 117 antelope were trapped in March, 1988 and transplanted to four ranches. The BLM is continuing to develop antelope management plans for resource areas.

Our research efforts are currently restricted to monitoring the effect of the parasitic stomach worm Haemonchus on antelope populations in the Roswell area. Above normal moisture conditions in the past two years have favored an increase of the worm in cattle, sheep, antelope and possibly deer. Concentrations of worms result in poor host body condition which predisposes them to indirect mortality factors. Livestock operators treat cattle and sheep, but currently there is no feasible treatment for free ranging antelope. Additional doe only licenses have been issued for this area to reduce the population before a die-off occurs. Winter and spring have been mild so weather related mortalities have been minimal. Dry weather conditions during the last eight months should have reduced the worm infection rate.

Landowners are realizing increased revenues from antelope hunting which raises some potential management problems. Licenses are allocated by ranch based on the percentage of deeded and public land. Some ranchers want more licenses for immediate monetary gain. Some want to reduce the total number of licenses which in effect reduces the number of public licenses. This in turn, increases the value of private land permits. About two thirds of the licenses issued to an average ranch are private. With a reduction in total licenses, the landowner can provide a "quality" hunt for the paid hunters without as many public hunters on the ranch. Some landowners want to divide their ranch into a private land ranch and a public land ranch with the same goal. In many cases the small scattered blocks of public land would not have public access or would be too small for hunting. The Department continues to encourage wildlife management on private land while attempting to maintain firm guidelines for hunt administration and allocation of licenses.

NORTH DAKOTA STATE REPORT

Jack Samuelson, North Dakota State Game and Fish Department, Mott

Mild winters continue to bless North Dakota as have our summers, consequently, the pronghorn has responded with increased populations. The July, 1987 pronghorn population survey indicated an increase of 34% over the 1986 data bringing our population to an estimated 5,500 animals with a buck:doe:fawn ratio of .31:1:.87.

Harvest from the 1987 gun season, which ran from October 2 through 11 (9-1/2 days), resulted in an 87.6% hunter success with a kill of 597 buck, 60 doe, and 84 fawn (total of 741).

The latest bow season information comes from the 1986 bow season which resulted in a 20.9% hunter success (666 license holder hunted, 139 harvested a pronghorn). Composition of the 1986 bow harvest was 48% buck, 15% doe and 37% fawn.

The bow season ran from August 29 through November 2, 1986 (63 days) and provided 4,901 man-days of recreation as compared to the 1,441 man-days of recreation provided by the 1987 gun season.

Generally, the picture for pronghorns appears good, with the federal and state agricultural programs promoting crop reductions and grassland increases which should result in additional pronghorn habitat; and if mother nature continues her mild manner ways the pronghorn should fare well!!

OREGON STATE REPORT

Ron Garner, Oregon Department of Fish and Wildlife, Hines

Oregon's antelope population has increased steadily the last few years to the present level of approximately 23,000 animals. A record 16,891 pronghorn were observed during the 1988 winter census which is conducted from fixed-wing aircraft during the period of late January to early March. All major antelope areas in the state are censused annually.

Summer herd composition is collected pre-hunting season (late July - early August) using fixed-wing aircraft. The buck ratio in 1987 was 32 per 100 does, which was 23% above the 10-year average. The fawn:doe ratio of 53:100 was 66% greater than the 10-year average.

The Department authorized 2,030 antelope tags for 1987, which included 1,410 rifle buck, 50 either-sex rifle, 500 archery and 70 muzzleloader tags. The harvest was a record 1,160 antelope. Rifle buck hunters had 82% success during the August 15-21 season. The chance of drawing a rifle buck tag in 1987 was 11.3%.

Most of Oregon's pronghorn are located in the southeast corner of the state on land managed by the Bureau of Land Management. The primary habitat modification in this area has been the nearly 300,000 acres of wildfire in the last two years. Many of these fires have benefited pronghorn by opening up large stands of homogeneous Wyoming big sagebrush.

The Oregon Department of Fish and Wildlife trapped 106 antelope on the Umatilla Army Depot in 1987. These animals were released in Wasco, Union and Baker counties.

Field work on Oregon's antelope research project is completed. The project addressed antelope habitat use, fawn mortality and the effect of coyote removal on antelope fawn survival. A report entitled "Fawn Mortality and Habitat Use Among Pronghorn During Spring and Summer In Southeastern Oregon, 1981-82," by Trainer, Willis, Keister and Sheehy has been published (Wildlife

Research Report Number 12). It is available from: Oregon Department of Fish and Wildlife, P.O. Box 59, Portland, Oregon 97207.

Additional reports on the project are scheduled to be submitted for publication in September of 1988.

SASKATCHEWAN PROVINCIAL REPORT

Dwight Dobson, Department of Parks, Recreation & Culture, Wildlife Branch, Maple Creek

The 1987 pronghorn survey as in 1986 was abbreviated to a sex and age composition from the traditional trend surveys.

The provincial population, estimated at around 13,000, continues to increase throughout the primary (grassland) and fringe (farmland) areas occupied by pronghorns with kid:mature doe ratios of 1.11:1 and 1.26:1 in 1986 and 1987 respectively.

This continued population increase appears to be as a result of mild winters, limited fawn mortality, a harvest designed for population growth and the pronghorns' ability to adapt to agriculture crops as a food source.

The mild winters experienced the last few years have resulted in pronghorns not concentrating in high densities on traditional wintering areas but utilizing a number of agriculturally developed areas in close proximity to the traditional winter ranges. These developed fields are being used throughout fall, winter and spring periods resulting in depredation concerns which have become significant issues in pronghorn management.

The pronghorn harvest is designed on a draw system for residents only with no restrictions as to sex or age. The quotas are set on a Wildlife Management Zone basis with seasons to accommodate both archery and rifle hunters. The quotas in 1987 were 300 archery and 3475 rifle licenses, up considerably from the 1981 quotas of 150 archery and 2400 rifle.

The rifle hunters experienced a success rate of 86% (2906 animals), harvesting 2.10 males/doe/0.15 kids, while the archery success of 30% was a slight increase over the 1986 rate of 23%.

The population objective for the mid 1980's of 8,500 pronghorns with a harvest of 2500 animals has been met, but rifle hunting demands still exceed the supply.

Present and future management strategies will certainly have to address the depredation problems which in some areas may be compounded with high population densities. Along with depredation, landowner tolerance levels of not only pronghorn population levels, but also hunter levels must be considered in managing pronghorns in Saskatchewan.

SOUTH DAKOTA STATE REPORT

John Wrede, Conservation Officer, South Dakota Department of Game, Fish and Parks, Rapid City

South Dakota antelope populations are gradually recovering from a severe winter kill of nearly 80% that occurred during the 1985-86 winter. The 1987 pre-firearm hunting season population estimates were established at 15,708 animals; an increase of 5% above the 1986 population estimate of 14,941. Population levels are still far below the near record number of antelope that occurred in 1983 when the state's population exceeded 67,000.

South Dakota continues to manage antelope by management units that are generally organized on county line boundaries. Conservation Officers are responsible for conducting late spring aerial census of adult popu- lations by using a 33 1/3% sampling technique that has been used in the past. In one of the smaller management units, the local Conservation Officer has implemented a 100% sampling process that is conducted at a higher altitude. To date, it appears that this method yields accuracy that is comparable to that of the 33 1/3% sampling method. We are looking at this method closely to see if it will reduce flight time, costs and maintain the same degree of accuracy that the 33 1/3% sampling method has provided. Management units with very low density populations (less that .10 antelope per square mile) are now being surveyed every other year to cut costs.. In the interim, Conservation Officers in those districts are depending upon random ground counts, trend indicators and landowner surveys to maintain population estimates and develop harvest recommendations.

Early summer aerial surveys of fawn production were discontinued in 1985 due to budgetary constraints. Additionally; there appeared to be no statistically valid correlation between spring natality and the following spring's adult population. A random ground count by management unit was implemented for use during the summer months of 1987. This proved less than satisfactory due, primarily, to observability factors (abundant tall sweet clover) and personnel time limitations. We expect to continue the random doe/fawn ratio ground survey in 1988. Data collected will be balanced against a five year mean

doe/fawn ratio established from the 1980 to 1985 aerial surveys. The projected mean doe/fawn ration statewide prior to the 1987 hunting season was 85 fawns per 100 does. The 1987 ground counts yielded a statewide average of 85.5 fawns per 100 does.

The primary archery antelope season opened in the western one half of the state and portions of two counties east of the Missouri River on August 15 and closed on October 2, 1987. An unlimited number of licenses were made available to both residents and non-residents in the main west river unit; 210 resident and 10 nonresident licenses were issued. A special archery hunting unit was established in one county in the far northeastern portion of the state with 10 permits sold to resident hunters only. That season ran from September 19 through October 2, 1987. Analysis of hunter report card returns showed a projected success of 9% and a projected kill of 20 animals; 9 adult bucks, 3 adult does, 6 doe fawns and 2 buck fawns

The firearm season began on October 3 and closed on October 11, 1987 in most units. The area involved in the firearm hunting units represents slightly more than 41,000 square miles. In 1987, all 1,690 resident licenses authorized for the season were issued. No non-resident licenses were authorized. Harvest in all units was projected to be 975 bucks and 296 does for a composite hunter success of 75%. A newly employed hunter harvest survey and reporting system did not permit the comparison of young to adult harvest or the sex ratios of harvested young antelope. A split season was implemented in one management unit along the eastern shore of the Missouri River to better manage hunter distribution and hunting pressure. The herd in that area is small and localized on private land and landowner tolerance of hunting pressure was managed best by the split season design. The season ran from September 26 to October 2 and October 3 through October 11, 1987.

Firearm antelope hunters in South Dakota may use either rifles or handguns that develop a minimum of 1000 foot pounds of energy at the muzzle as rated by factory specification. Primitive firearm hunters are confined to use black powder type weapons of at least 42 caliber.

The main antelope range in South Dakota is contained in an area in the western one half of the state that comprises nearly 41,000 square miles. Some of that range is located on Indian reservations. During peak population periods, nearly all of that range is occupied with varying densities of animals that occur as a result of habitat variables. The primary range is found in 4 counties in the far western region of the state; three of which border Wyoming and Montana. These western counties have the most desirable habitat, the least amount of ground broken out for small grain production, the greatest reproductive rates and therefore the greatest densities of antelope per square mile.

Migration movements of antelope in South Dakota appear to be significant only during unusually harsh winters. The winter of 1985-1986 stimulated some southward migration that has left noticeable, uneven distribution of antelope throughout their range in the years since. To date, large, unpopulated gaps in the primary range are evident whereas other, non-traditional ranges appear to have a few resident animals that took up residence in those areas after warmer weather arrived in the summer of 1986. It is not known whether this is due to winter survival patterns or migration relocation. Some northward return of antelope was noted during that summer but the distance and final destinations of those animals is also unknown. Migrational movement of small numbers of antelope from Wyoming and Montana into South Dakota's western border counties was also noted. Fences and natural river barriers appear to restrict annual migrations of any magnitude.

In December 1985, the South Dakota Department of Game, Fish and Parks assisted the state of Wyoming with an antelope trapping project. From that operation, 104 antelope were translocated by Game, Fish and Parks personnel to the Crow Creek Indian Reservation in Buffalo County, South Dakota. The release site was located on the east side of the Missouri River south of the state's capitol of Pierre. The transplant was completed as part of the state's obligation to the Crow Creek Tribe established in a cooperative management agreement between the state and the Tribe. The transplant did not meet the objective of establishing an antelope population on the Crow Creek Reservation. After their release, few of the animals remained within the reservation boundaries. The vast majority of the introduced antelope took up

residence with small, resident herds that ranged approximately 25 to 30 miles north of the release site. Other individual animals wandered into the eastern South Dakota farm country and eventually disappeared.

After the 1985-1986 winter, South Dakota antelope management objectives have once again shifted from harvesting enough antelope to keep herd growth in check and stay within landowner tolerance levels to rebuilding the herd to a goal that approximates the 1985 post hunting season level of 32,000 animals statewide. This number appears to be the point at which supply of hunting recreation meets the demand and landowner complaints are manageable. Emphasis is being placed on more uniform harvest recommendations and retarding historical , rapid herd growth to avoid the boom and bust licensing regulation that has plagued us in the past. Hunter selectivity is still a difficult problem. In 1987, South Dakota antelope hunters harvested 3.3 bucks for every doe. This repre-sents an even more inequitable harvest ratio from the 3.0,2.5 and 2.2 during the years of 1981, 1983 and 1985 respectively. In 1983 and 1984, an any antelope license combined with a doe/fawn bonus tag seemed to improve the buck/doe harvest rate. We may resort to this licensing strategy again as early as 1989 provided that herd growth occurs at the customary rate. We do not foresee any non-resident hunting opportunity in South Dakota until the previously mentioned population goal is reached.

There are no research projects planned or in progress at the present time in South Dakota but alternative management survey methods are being discussed in an effort to maximize effort for the diminishing amount of dollars available. We feel that the present aerial survey of adult populations in the spring of each year yields a reasonably accurate estimate of populations but determining recruitment of fawns into the adult population continues to be a source of concern. As was mentioned previously, doe/fawn ratio flights have proven unreliable in predicting the survivability of fawns through the first year of life. Developing an inexpensive, effective and reliable survey to determine fawn survival that is not overly demanding of the Conservation Officers' time will continue to be one of South Dakota's management goals. In order to minimize the effects of observer biases in survey flights, we plan to implement a familiarization and training program that will stress uniformity and consistency in survey performance. Population modeling through the use of

the Pop II system is also being considered as a supplement to base line survey results.

TEXAS STATE REPORT

Ted L. Clark, Texas Parks and Wildlife Department, Austin

All pronghorn antelope in Texas are found west of the 100th meridian, which is the boundary between the Texas Panhandle and Oklahoma. Sustaining pronghorn populations currently occupy approximately 13.5 million acres in the High Plains, Rolling Plains, Edwards Plateau, and Trans-Pecos Ecological Regions. Data are reported by the three administrative districts of the Wildlife Division where pronghorn occur; Trans-Pecos, Panhandle, and Possum Kingdom.

For the period 1977-87 the Texas pronghorn population has fluctuated between 12,000 and 26,800; averaging about 18,500 with approximately 70 percent occurring in the Trans-Pecos, 20 percent in the Panhandle, and 10 percent in the Possum Kingdom District of West Central Texas (Table 1). Range conditions have been unusually good in western Texas during 1985-87 and the pronghorn population has numbered more than 26,000 for each of these years. As a result of current drought conditions, the population is expected to decline during 1988.

The 9-day hunting season opens the Saturday nearest October 1. The bag limit is one pronghorn per hunter per season. All pronghorns legally taken in Texas since 1941 have been by permits issued by the Parks and Wildlife Department free of charge to landowners based upon annual aerial surveys. Permits are issued at a rate to maintain the pronghorn population at the carrying capacity of the range and to maintain a posthunting season adult sex ratio of 1 buck per 4 does. The permits may not be sold, however; the hunter must negotiate with the landowner to obtain access to hunt.

The number of hunting permits issued varies from about 900 to 2,500 annually and averages about 1,500. Harvest of pronghorn during the period of 1977-87 ranged from 538 in 1983 to an all-time high of 1,017 in 1987 (Table 2). Typically, hunter success is high, averaging 92 percent. The harvest of pronghorns is very conservative, as reflected by the permit utilization rate which is declining and averages 50 percent.

Relocation of pronghorns continued, with 294 and 234 being captured on the Rocker B Ranch in Reagan and Irion Counties in 1986 and 1987, respectively. Of the 294 released in 1986, 106 went to the State of Arizona, 127 were released on 5 restoration areas in the Permian Basin of West Central Texas, and 61 were relocated on the Rocker B Ranch. In 1987, 100 pronghorns went to the State of Arizona, 79 were released on 3 restoration areas in Texas, and 55 were relocated on the Rocker B Ranch.

Historically, 2 subspecies of pronghorn antelope are reported to be endemic to Texas; Antilocapra americana americana and A. a. mexicana. The subspecies americana occurred in the Texas panhandle with mexicana occupying the remainder of the historic range in the State.

Currently, the primary source of pronghorns for restocking is the Rocker B Ranch in Irion and Reagan Counties of the Permian Basin. The subspecies of Rocker B pronghorns is uncertain and the Department has refrained from transplanting pronghorns from the Permian Basin to the Trans-Pecos since 1974 in order to maintain the integrity of the endemic mexicana subspecies.

In an effort to determine subspeciation of pronghorns occurring in the Permian Basin and Trans-Pacos populations, liver samples were collected from hunter-harvested animals during the 1987 hunting season and were subjected to electrophoretic analysis under a reciprocal agreement with the Department of Wildlife and Fisheries Sciences at Texas A&M University. The final report on this study is expected to be available in early June.

Table 1. Estimated pronghorn antelope population by Wildlife District in Texas, 1977-87.

YEAR	TRANS-PECOS BUCKS	TRANS-PECOS DOES	TRANS-PECOS FAWNS	TRANS-PECOS TOTAL	PANHANDLE BUCKS	PANHANDLE DOES	PANHANDLE FAWNS	PANHANDLE TOTAL	PERMIAN BASIN BUCKS	PERMIAN BASIN DOES	PERMIAN BASIN FAWNS	PERMIAN BASIN TOTAL	TEXAS BUCKS	TEXAS DOES	TEXAS FAWNS	TEXAS TOTAL
1977	2182	4096	2049	8327	1040	2530	1103	4673	573	654	484	1711	3795	7280	3636	14711
1978	2188	4257	1547	7992	1362	2642	555	4559	211	531	181	923	3761	7430	2283	13474
1979	2936	4875	4244	12055	1264	2908	633	4805	296	521	530	1347	4496	8304	5407	18207
1980	3241	4678	625	8544	814	2084	466	3364	247	407	238	892	4302	7169	1329	12800
1981	2865	4766	4444	12075	918	2132	230	3280	311	563	477	1351	4094	7461	5151	16706
1982	3669	5859	2619	12147	910	2150	682	3742	546	807	616	1969	5125	8816	3917	17858
1983	2240	4383	1051	7674	814	1795	392	3001	367	575	394	1336	3421	6753	1837	12011
1984	4053	8289	3529	15871	426	1058	243	1727	140	245	110	495	4619	9592	3882	18093
1985	5114	10941	4224	20279	771	1908	357	3036	828	1368	1243	3439	6713	14217	5824	26754
1986	6378	10014	3405	19797	848	1927	345	3120	966	1264	975	3205	8192	13205	4725	26122
1987	5740	9603	5165	20508	962	2447	494	3903	785	870	761	2416	7487	12920	6420	26827
1977-87 Mean	3691	6524	2991	13206	921	2144	500	3565	479	710	546	1735	5091	9377	4037	18505

Table 2. Statewide pronghorn antelope harvest in Texas, 1977-87

Year	No. Landowners Issued Permits	Acres In Permit Issuance	No. Landowners Allowing Hunting	No. Permits Issued		No. Antelope Harvested			1/ Percent Permit Utiliz.	No. Hunters	2/ Percent Hunter Success	3/ Sample Size
				Buck	Doe	Buck	Doe	Total				
1977	250	5,743,238	196	1,348	25	916	2	918	67	986	93	--
1978	337	6,172,751	248	1,168	0	748	0	748	64	833	90	84
1979	352	6,253,719	295	1,398	23	897	1	898	63	1,007	89	88
1980	348	5,812,379	283	1,281	0	841	0	841	66	946	89	90
1981	135	3,590,397	113	918	0	595	0	595	65	632	94	93
1982	215	5,051,829	174	1,418	21	821	16	837	58	883	95	98
1983	257	6,153,227	192	1,179	5	538	0	538	45	584	92	91
1984	192	5,291,507	128	1,246	86	594	0	594	45	646	92	80
1985	175	4,469,277	128	1,618	193	715	30	745	41	794	94	86
1986	198	4,704,727	145	2,303	285	800	27	827	32	895	92	90
1987	284	6,022,011	197	2,425	106	979	38	1,017	44	1,103	92	99
1977-87 Mean	249	5,387,733	191	1,482	68	768	10	778	50	846	92	--

1/ Obtained by dividing the total number of antelope harvested by the total number of permits issued.

2/ Obtained by dividing the total number of antelope harvested by the total number of hunters.

3/ Percent return information on number of permits issued.

UTAH STATE REPORT

Donald M. Beal, Utah Division of Wildlife Resources, Cedar City

Pronghorn antelope are widely distributed in Utah despite low numbers. They currently exist in small scattered bands on 17 different areas or herd management units within the State. About 40 percent of these occupy the western desert areas and the remainder are in the northeast corner and in the south-central parts of the State. Populations in some herd units have increased in recent years, largely as a result of improved fawn survival. Total numbers, based on aerial trend counts and assuming 80 percent coverage, are estimated at 8,300 statewide.

Habitat used by Pronghorns has not changed significantly in recent years, but in some areas there has been a shift from winter grazing by sheep to winter grazing by cattle. There is less diet overlap and competition for forage between pronghorns and cattle than with sheep and as a result, some pronghorn populations have responded favorably.

Pronghorn antelope are hunted in Utah in September and early October on a permit basis. Applicants are allowed no more than one permit every three years. Over the past ten years, the interest in antelope hunting in Utah has increased significantly. For example, 1,078 persons applied for 152 permits issued in 1968 and harvested 114 bucks. By 1976, the number of applications for permits to hunt pronghorns had increased to over 4,000 per year. In 1984, there were 5,818 applications for 739 permits and these permittees harvested 669 pronghorns, including 169 does and fawns. In 1986 there were 6,466 applications for 909 permits and they harvested 491 bucks, 243 does and 45 fawns. For the 1987 hunting season, there were 1,161 permits available, including 585 for a buck and 576 for a doe or a fawn. Hunters with a buck permit may also purchase an archery permit to hunt during the 15-day archery season held prior to the regular hunt.

Management data obtained annually in Utah include late summer fawn to doe ratio counts, winter trend counts, and harvest information. August fawn to doe ratios have improved on some herd units during the past two years. The average ratio in 1986 was 56 fawns per 100 does.

Research programs with pronghorn antelope in Utah, which were active between 1961 and 1980, have been completed and no additional studies are planned at this time.

The Utah Division of Wildlife Resources, in cooperation with other agencies, is continuing efforts to expand pronghorn populations by trapping and moving animals into new areas where habitat is suitable. In winter of 1984-85 a total of 469 pronghorns were trapped from Awapa Plateau and Snowville to reduce population numbers. One hundred forty nine of these were shipped to Nevada and 320 to release sites in Utah. In winter of 1985-86, 1986-87 and 1987-88 a total of 301,319, and 291 pronghorns respectively, were trapped from the Awapa Plateau and released at other sites in Utah.

WYOMING STATE REPORT

Richard J. Guenzel, Wyoming Game and Fish Department, Casper

Pronghorn in Wyoming are managed by objective, a process that includes both biological and political consideration towards the management of the species. The state's pronghorn are divided into herd units (populations) delineated by topography, fences, and highways. The state-wide objectives for pronghorn are to provide 84,756 animals for harvest at a rate of 90.0 percent success and 2.2 days of hunting per animal taken. This strategy will produce 185,794 hunter recreation days annually.

Distribution

Pronghorn are found nearly statewide within 53 herd units that comprise 112 hunt areas. They seasonally occupy 68,768 square miles of habitat, of which 6,169 square miles are considered crucial.

Population Estimate and 5 year Trends

The post season population estimate for pronghorn was 339,483 animals, slightly below the statewide objective of 359,150. The population currently is increasing following the severe winter of 1983-84 when a number of pronghorn died. Summary statistics for the past five years are presented in Table 1.

Productivity and Recruitment

Preseason pronghorn classification surveys, conducted in August and September, generally estimate between 75 and 105 fawns per 100 does.

Recruitment into all age classes has not been a significant problem for pronghorn populations in Wyoming; however, the heavy harvest of males, as an inducement to sell doe/fawn licenses, in some areas has reduced the average age of some herds.

A recent study of productivity in relation to harvest strategies showed that recruitment was not significantly affected by hunting during the rut (Forrest 1985). Fawn/doe ratios from 55 herds from 1977-1982 were unaffected by hunting during the rut.

Harvest Strategies

The estimated 1987 pronghorn harvest in Wyoming was 55,150 animals including 27,820 bucks, 23,646 does, and 3,684 fawns. Hunter success was 127 percent (hunters can hold more than one license). Residents held 55 percent of the licenses and nonresidents held the remaining 45 percent.

Pronghorn populations in which there is a large proportion of public land are often managed towards higher buck/doe ratios than areas with mostly private lands. A ratio of 40 bucks:100 does is the objective for many of these public land populations, particularly in western Wyoming where large tracts of public lands allow higher populations to be maintained without complaints of antelope damage to private lands.. This trophy management approach is often not possible in herds on chiefly private lands because of actual or perceived conflicts with agriculture.

In populations managed for trophies, herd numbers are controlled by issuing doe/fawn licenses. In most of Wyoming, a hunter can have one regular and two doe/fawn licenses, or three doe/fawn licenses. In other areas, a hunter can buy an unlimited number of doe/fawn licenses. On public land, this system has worked well; on private lands, access fees and lack of buck hunting quality have left many licenses unsold.

Translocations

Antelope were trapped and relocated to the Wind River Indian Reservation in 1987. Pronghorn herds on the Reservation are slowly being reestablished since enforceable game laws were recently introduced on the Reservation.

Special Study Results

A new pronghorn trap was constructed in 1987 following a Colorado Division of Wildlife design which included several modifications and improvements over the old trap. The new trap consists of prefabricated wing panels each 10 x 8 ft. (3 x 2.5 m), 15 panels per side, and a corral made of steel pipe held in place by specially built joints arranged in an octagonal fashion. Special gates were also included where the wings join the corral and where the wing panels connect to remesh fence. The primary advantage to this new trap design is that a crew can have the trap operational within 2 hours; the old trap took 8 to 12 hours. This allows trapping at more than one site per day.

Ongoing Research

Most of the studies currently underway focus on herd unit boundary delineation. These include two projects in central Wyoming and one project in southwestern Wyoming. Marked animals are used to determine herd movements and population distributions.

An investigation will begin in July 1988 which will focus on the effects of energy development on pronghorn and mule deer. Marked animals will be used to quantify the effects of oil and gas extraction on crucial winter ranges in central Wyoming.

Management Problems

Of concern in Wyoming is the problem of how to maintain quality pronghorn hunting on private lands. Though sportsmen and landowners desire high buck/doe ratios with a large number of older bucks, agriculturalists have been increasingly intolerant of the high pronghorn populations necessary to achieve this goal. Present management strategies are to maintain at least 30 bucks;100 does for herds occupying largely private land areas.

> Fencing continues to be a problem in Wyoming where highway and federal grazing allotment fences often restrict seasonal migrations of pronghorn. We continue to work educating agencies on the problem of fencing

across migration/movement corridors of big game populations. Despite this, thousands of pronghorn are killed directly or indirectly by fences in every severe winter.

Perceived pronghorn damage to agricultural lands is also a significant problem in Wyoming. Landowners have been reluctant to accept food habit studies which show that pronghorn are not competing for forage with domestic livestock. Recent studies in Colorado which determined that pronghorn foraging on winter wheat were not lowering wheat production have also met resistance from the agricultural community. Preconceived notions are changed only with difficulty.

TABLE 1. Five year trends in the pronghorn program in Wyoming.

Fiscal Year	Harvest	Rec. Days	Success (%)	Days/ Animal	License Sold	License Revenue($)	Management Costs ($)	Hunter Expenditures($)
FY83	79,515	148,266	87	1.86	91,595	3,703,621	1,845,742	18,538,921
FY84	98,680	182,162	92	1.85	112,927	4,659,865	2,473,988	24,091,840
FY85	83,038	174,579	90	2.10	97,747	4,617,803	1,860,539	24,693,920
FY86	68,198	158,178	113	2.32	82,549	4,042,662	2,065,887	23,833,457
FY87	62,440	154,762	120	2.48	78,810	3,732,442	2,561,243	23,164,931

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TECHNICAL SESSION

HISTORICAL REVIEW OF PRONGHORN POPULATIONS AND MANAGEMENT IN YELLOWSTONE NATIONAL PARK

M. Douglas Scott, Research Division, Yellowstone National Park, National Park Service

Historical (1875-1910) guesses of pronghorn numbers in Yellowstone National Park ranged from 500 to "thousands". The first reliable inventory was conducted in 1923, and 253 were counted. Reasonably accurate counts showed pronghorn numbers climbed to about 800 in the late 1930's to early 1940's. From 1945 through 1981, the population underwent a long slide downward, with temporary partial recoveries in some years. The lowest but somewhat unreliable count of 102 was obtained in 1981, while the lowest reliable count of 121 occurred in 1977. Between 1947 and 1967, managers removed 1,015 pronghorns from the park (mean of 48.3 per year) with the intention of bringing the presumably large numbers into balance with a possibly dwindling food supply. These sporadic reductions (1-8 years apart), alone, appeared to have little lasting effect on pronghorn numbers. For example, the pronghorn population rebounded within 1 year following large reductions in 1951, 1954, and 1966--showing a density-dependent response to human predation. However, during the entire 1947-67 reduction period, it was evident that numbers never quite rebounded as much as they should have, even though sometimes given several years to do so. Clearly, there were other, more basic, factors that caused a gradual decline in pronghorn numbers. Further evidence that the Park Service reductions were not the basic cause of the population decline was provided by the fact that the slide continued for 15 years after the removal program stopped in 1967. Since the beginning of

1982, the pronghorn population has increased at an exponential rate. The latest complete count (March 1987) found 478 animals. Analysis of historical management records and climatological data indicated there were five major factors that interacted to determine whether the antelope herd increased or decreased. These were, in decreasing order of importance: 1) precipitation during November through March, when pronghorns were on winter range (levels above average are detrimental to an animal's energy balance); 2) access to native winter range for food (free access is desirable); 3) availability of crops like hay and grain for winter and early spring food (more crops, up to a point, are desirable); 4) precipitation during the June kidding season (levels above average are detrimental to a kid's energy balance; and 5) total annual precipitation available to food plants (extremely dry years are undesirable). When three or more of these five factors were favorable for a number of consecutive years, the herd increased or maintained a high population level. When three or more factors were neutral or unfavorable, the herd declined or maintained a low population level. During any given time period, only one limiting factor may have been most decisive. One example of this was during the drought years of the first half of the 1930's when the pronghorn herd declined greatly, even though hay was fed to them in winter and winters were mild. Lack of browse production, exacerbated by a park sagebrush eradication program at this time, evidently caused the decline. Conversely, linear regression analysis of 1982-87 population data showed that the percent rate of growth in the pronghorn herd increased by about 18 percent with each added inch of total annual precipitation. However, this relationship may have been possible only because nearby private agricultural lands began providing food at a critical time in the winter in these years, and because most of these winters were unusually mild. Emigration of pronghorns from Yellowstone has never been demonstrated.

IMPACTS OF COYOTE REMOVAL ON PRONGHORN FAWN SURVIVAL

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Abstract: Pronghorn fawn survival was measured relative to aerial coyote removal 1985 - 87 on the Jackass Creek Study Area, Harney County, Oregon. Comparisons of August fawn:doe ratios (F:D) were made for the study area during pre-removal years 1976 - 84 (F:D $\bar{x}$ = 13.6) with removal years (F:D $\bar{x}$ = 61.1) (P = 0.10); during pre-removal years on the study area versus the remainder of Harney County (F:D = 30.5) (P = 0.000); and during removal years on the study area versus the remainder of the county (F:D = 48.7) (P = 0.425). Coyote removal entailed two sessions per year, one and three weeks prior to normal peak of fawn drop, 20 May. Approximately 24 hours of flight time was used annually on the 39000 ha study area. Fawn survival on the study area during removal years increased dramatically over pre-removal years and over the remainder of the county. High intensity, short duration coyote removal is deemed to be an appropriate and cost effective management application for pronghorn populations with poor fawn survival during periods of medium to high predator abundance.

PRONGHORN FAWN MORTALITY RELATED TO LIMITED COYOTE CONTROL ON THE NATIONAL BISON RANGE

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Jon Malcolm, National Bison Range, Moiese, Montana

INTRODUCTION

Pronghorns (Antilocapra americana) were successfully introduced to the National Bison Range (Range) in 1951. Earlier transplants, before the advent of sodium monoflouroacetate (1080) for predator control, had failed. The 15 animals introduced during 1951 increased to 120 by 1962, despite the removal of more than 44 for studies while the population was still small. Fawn recruitment remained high until 1970, when transplanting or cropping of at least half of the population in alternate years became necessary to limit population growth. Preparation and outdoor storage of 1080 baits on the Range, which resulted in unplanned but very effective coyote (Canis latrans) control, were discontinued during the late 1960's. Fawn mortality, which previously had not exceeded 65%, increased to 77% in 1970 and remained high; it was 83% in 1971, 93% in 1972, and 90% in 1973 (Showers Corneli et al. 1984).

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[1] U.S. Fish and Wildlife Service; Montana Fish, Wildlife and Parks; University of Montana; and Wildlife Management Institute cooperating.

An increase in coyote numbers, concurrent with increased fawn mortality, was apparently a response to the cessation of all predator control and prompted a study of coyote-prey relationship on the Range during 1974 and 1975. Although Microtus spp. were the most common food item in coyote scats throughout the year, pronghorn fawns were common during the fawning season. Coyote predation was apparently the main cause of death among fawns fitted with transmitters in 1975, when the mortality rate was 69% (Reichel 1976).

Von Gunten (1978) studied pronghorn fawn mortality on the Range during spring and summer 1977. Showers Corneli (1980) continued the study in 1978 and reduced coyotes during spring to determine if compensatory mortality would replace coyote predation. An estimated 95 fawns were born during 1977, and 85 (89%) had died by late September; during 1978, 65 of 92 (71%) had died by mid-October. Among the radio-equipped fawns that died, most were dead within three weeks after birth; 21 of 30 fawns (70%) died in 1977, and 29 of 34 (82%) died in 1978.

During both years, a fawn's fate was related to its location. Fawns born in Alexander Basin during 1977 died at earlier ages than those born on the southeastern range. Two fawns born on the southeastern range moved to Alexander Basin when they were 33 and 35 days old, respectively, and died 2 and 5 days later. Both deaths involved coyotes.

During 1978, when 19 coyotes were killed, 13 (93%) of 14 fawns tagged in the southeast died; only 3 (27%) of 11 tagged fawns died in Alexander Basin (where coyote control was centered). Of 4 fawns radio-tagged on the northside, near Alexander Basin, 50% died; 80% of 5 fawns radio-tagged in the lower western pasture died (Showers Corneli et al. 1984).

Although coyote numbers on the Range seemed to be as high during 1979 and 1980 as they were in 1977, before limited control, 22 fawns survived in 1979 (despite the herd being reduced from 138 to 78 by extensive winter mortality. Coyote predation on fawns had resulted in an old-age herd, and 23 of the 32 dead animals found were 8 years old or older (Showers Corneli 1980). Pronghorns ordinarily live about 9 years. Thirty fawns survived in 1980. Apparently those coyotes replacing the experienced ones that were killed during 1978 were not efficient predators of fawns. By 1982, survival was down to 5 fawns.

STUDY AREA

The 7,700-ha Range is at the southern end of the Flathead Valley in western Montana. It is primarily a Palouse Prairie grassland with timbered areas at higher elevations and along Mission Creek. Elevation ranges from 696 m to 1,361 m. The southern half of the Range is steep, rocky, and dissected by canyons. Pronghorns congregate primarily on the flatter grasslands. The Range was described in detail by Kitchen (1974).

RESULTS

From 1978 to 1984, the pronghorn population on the Range decreased from 138 to 116 (Range Narrative Reports). The decrease, in itself, was not cause for concern. However, the age structure of the herd was skewed to old animals by 1984. More than half of the herd had been born during 1978-1980 after the limited control action taken during 1978. Thus, about half of the herd was 4 - 6 years old and almost half was older than 6. The coyote control conducted during 1978 allowed good fawn survival just before and after the herd reduction, and the herd soon regained its lost numbers. Without that control, the herd probably would have dwindled rapidly as coyotes hunted harder for the few fawns available. Another severe winter could have led to extirpation. During the period when many pronghorns were being transplanted into unoccupied ranges in Montana, success increased with size of transplants up to about 100 animals, especially where predators were numerous (McLucas pers. comm.). In populations smaller than 100, social bonds seemed to break down, normal herding and predator defense mechanisms ceased to operate, and territoriality was reduced.

Although trappers were taking coyotes at the perimeter of the Range, fawn survival was down to 1 animal in 1984. The possibility again existed of a severe winter drastically reducing an over-aged herd, and fawn survival would not have been adequate for the population to rebuild. Most bucks on the Range were not territorial after the die-off in 1979, and territoriality had not been reestablished by 1984, an indication of social instability resulting from a skewed age structure. A decision was made to begin "casual" coyote control. Range personnel began carrying rifles in their vehicles and shooting coyotes

as chances occurred. Twelve coyotes were shot during 1984, 15 were taken in 1985, and 8 were shot during 1986. Eighteen fawns survived through summer 1985, 20 through 1986, and 27 through 1987. The pronghorn population increased from 116 during winter 1984-85 to 146 during winter 1987-88, and about 65 were young animals. The level of control in no way endangered the coyote population; 26 were observed during a helicopter census in January 1988.

DISCUSSION

Coyotes are apparently the main predators of pronghorn fawns, which are often killed before 1 month of age. Coyotes occasionally kill adults. Grinnell (1897) watched three coyotes chase a pronghorn doe and kill her. They took turns, and as one chased her the others rested. If the pronghorn had run a straight course, she would have eluded the predators. Instead, she ran in large circles, as pronghorns are prone to do. The resting coyotes ascended hills or knolls to keep the chase in sight. When the doe turned back toward a waiting coyote, the predator would sneak into her path and take up the chase. Similarly, Animal Damage Control personnel of the U.S. Fish and Wildlife Service have told me of watching from aircraft as pairs of coyotes ran adult pronghorns in relays and killed them.

Bobcats (Lynx rufus) are apparently the second major predators of pronghorn fawns. Bobcats seem to be more efficient predators of older fawns than are coyotes, because bobcats stalk close to a victim before attacking. Generally, bobcats live in more rocky, brushy country than do coyotes. When pronghorns enter such country seeking succulent forage, their speed is probably reduced by the terrain and vegetation.

Golden eagles (Aquila chrysaetos) seem to rank third as predators of pronghorn fawns. However, they are apparently the primary predator of adult pronghorns today. The pronghorn's speed, which foils most mammalian predators, is easily matched by the eagle. The open-field running of pronghorns make them easy prey for the big birds. We receive about 10 reports of eagles attacking or killing pronghorns for every one of coyotes chasing pronghorns.

The high reproductive potential of pronghorns (Buechner 1950, Ellis 1972) permits populations to remain stable despite high fawn mortality if losses from the adult population are low. An Oregon population remained stable for 17 years with an annual recruitment of only 26 fawns:100 does (Yoakum 1978). However, successive years of low recruitment in isolated populations, such as the Range herd, may cause population declines, and a natural stability of predator-prey interactions seems unlikely. Coyotes do not depend on pronghorns for survival (Reichel 1976); thus, their numbers would not be checked by declining pronghorn numbers. Recovery from a decline would be further hampered because fences confine the pronghorns with experienced predators. The level of fawn survival needed to maintain a stable population has not been determined. However, 10-20% survival is apparently sufficient, and such survival precludes the need to otherwise control the population.

Predation remained the predominant cause of death among pronghorn fawns in 1978 following limited coyote control, but more fawns survived in 1978 (29%) than in 1977 (10%). Although fawn mortality remained high during 1978, rates in the 2 major fawning areas differed widely: 27% in Alexander Basin, where most of the coyote control occurred, and 93% in the southeastern

pasture. In Alexander Basin, 90% fawn mortality in 1975 and 93% in 1977 was attributed primarily to coyote predation. Other factors (disease, abandonment by dams, precipitation, or food supply) did not significantly affect fawn mortality (Von Guten 1978, Showers Corneli 1980). The dramatically improved survival during 1978 apparently was a result of removing the resident coyotes. However, control was not extensive enough to affect the whole range and did not affect predation other than that caused by coyotes. Alexander Basin has been the site of coyote dens occupied by at least 1 breeding pair since 1974 (Reichel 1976, Van Guten 1978) and traditionally had also been a major pronghorn fawning area (Kitchen 1974, Reichel 1976, Swanger 1977). The numerous fawns born in that area may have provided resident coyotes with hunting experience, improving their efficiency. In Alexander Basin, other mortality factors did not compensate for the absence of coyote predation in 1978.

Showers Corneli et. al (1984) predicted that if successive years of high predator-caused mortality threatened the breeding population on the range, predator control would become necessary to maintain the pronghorn herd. Improving postnatal survival should result in increased numbers of adult pronghorns unless some factor other than predation has changed dramatically on the range since the early 1970's, when coyotes increased substantially. Before that time, the herd nearly doubled (and half of it had to be removed) every 2 years (Range Narrative Reports).

The situation on the Sheldon National Wildlife Refuge in Nevada shows that predator control can make a difference in fawn survival. Between 1955 and 1967, an average of 160 coyote and 53 bobcat carcasses were recovered

annually through trapping and aerial gunning. The additional, and no doubt significant, effect of 1080 use was unknown. The number of fawns per hundred does, from late summer censuses, during periods with and without predator control averaged 61 during 1955-1967 and 25 during 1968-1980 (McNay 1977). However, the comparatively unhunted herd on Sheldon has increased about 2.5 fold during the last 10 years despite low fawn survival (M. Kaschke pers. comm.). However, much of the predator control success on the Sheldon was undoubtedly due to 1080 bait stations. Presently, 1080 is outlawed, and aerial gunning is considered the most practical authorized method of control (Connolly 1978). By itself, aerial gunning would probably be ineffective on the Sheldon where heavily vegetated hillsides and rocky canyons conceal predators near the major fawning areas. Thus, continued control would be extremely expensive and probably ineffective.

Helicopter gunning on the Range would probably be effective, but it would also be expensive and, to some extent, disruptive to bison (Bison bison) and other big game during spring. The comparatively few coyotes removed by shooting from the ground was more than adequate to reverse the downward trend in the pronghorn population. In fact, a reduction or 1- or 2-year suspension of control may be necessary to avoid an overpopulation of pronghorns on the unhunted Range.

Reduction in the number of experienced coyotes, not all coyotes, is apparently sufficient to promote adequate fawn survival. This experience on the National Bison Range indicates that sport hunting of coyotes on refuges such as the Hart Mountain and Sheldon National Wildlife Refuges could increase fawn survival at no expense, and at the same time not significantly reduce the total coyote population.

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TOPOGRAPHIC CONSIDERATIONS OF PRONGHORN WINTER RANGES IN RELATION TO SNOW AND WIND: AN OVERVIEW AND PRELIMINARY ANALYSES

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ABSTRACT

Topography is an extremely important component on many pronghorn (Antilocapra americana) winter ranges because of its interaction with snow and wind. Principles of snow transport, topographic configuration and their relation to pronghorn winter habitat suitability are presented. Concepts such as wind erosion capability, equilibrium snowdrift capacity, moving snow boundaries, and dynamic habitat preferences are introduced in relation to pronghorn winter range. Methods are available to quantify winter range topography in a biologically interpretable manner. A preliminary Snow Capacity Index (SCI) is developed and applied to pronghorn winter range analysis for the Red Rim area of south central Wyoming. This index incorporates topographic slopes, deviation of ridges from prevailing winds and optimal snowdrift orientation. This SCI measures the ability of topography to drift snow while providing wind protection in lee areas and reduced snow depths downwind. SCIs were used to test whether the Red Rim pronghorn winter range had significantly higher snow capacity than adjacent nonwinter range areas. Winter range topography had a significantly higher mean SCI than adjacent nonwinter range ($p=0.0003$). Nonwinter range topography deviated significantly more than winter range terrain form optimal snow and wind orientation ($p=0.02$). Implications to winter range evaluations, mine reclamation and habitat selection studies are discussed.

MIGRATION OF FORT ROCK AND DUNCAN RESERVOIR PRONGHORN, OREGON

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INTRODUCTION

Although not as abundant as in Wyoming or Montana, pronghorn (Antilocapra americana) are common in the Great Basin area of Oregon. They are generally associated with sagebrush (Artemisia spp.) habitat types and most herds migrate between summer and winter ranges. Pronghorn are considered a trophy big game species in Oregon and hunts are usually designed to provide quality hunting opportunities with buck only harvests. Occasionally either sex hunts will be used to alleviate a specific damage situation. In south central Oregon two studies were done to define summer range and migration routes used by two wintering pronghorn herds.

Historically, a herd of 450-550 pronghorn has wintered in the Fort Rock valley. With the advent of center-pivot irrigation in the 1970's, much of the Fort Rock valley was put into alfalfa fields for the production of dairy quality hay. Subsequently, the wintering pronghorn shifted diet from sagebrush/native forb to alfalfa hay and new alfalfa seedings. By the early 1980's the damage problem had gotten to the point that more was needed than just providing hazing material and repellants. It was assumed that this herd of pronghorn summered northeast of the Fort Rock valley in the area of Benjamin Lake. In 1983, a study was designed by the Oregon Department of Fish and Wildlife (ODFW) to determine the summer range and migration route used by the Fort Rock herd.

The second study took place on a herd of pronghorn that wintered in the vicinity of Duncan Reservoir about five miles southeast of the town of Silver Lake, Oregon. This herd historically numbered around 150 animals but in the late 1970's it started to increase. Winter counts went from 69 in 1972, to 305 in 1983, to 664 in 1986 (Unpubl. data, ODFW files). Only about 20 pronghorn were present in the area during the summer. Seasonal use patterns and migration routes were not known for this herd and this information was needed for more effective management as well as the integrated management of other land use practices in the area. Land ownership within the wintering area of the Duncan herd was about 30 percent private and 70 percent Bureau of Land Management (BLM). In 1986 a cooperative study between ODFW and BLM was initiated to determine seasonal use patterns and migration routes of the Duncan herd, determine a reasonable population estimate and define kidding areas.

Study design and field work on the Fork Rock study were done by Steve Denney and Norm Behrens, ODFW. Study design on the Duncan Reservoir study was done by Merv Wolfer, ODFW and Dave Pulliam, BLM. Field work on the Duncan Reservoir study was done by Merv Wolfer and Craig Foster.

METHODS

In February 1983, 9 adult doe pronghorn were collared with radio transmitters in the Fork Rock valley. Because of the small number needed and limited successes of previous capture attempts using drive traps, animals were drugged using powdered succostrin (Succinylcholine Chloride). The drug was loaded into 6-11 milligram (mg) Pnue-darts with 1 inch non-barbed needles and

fired from an Enstrom helicopter. A CO_2 dart rifle was used because of the animals relatively thin skin. Review of the literature showed no information on darting free ranging pronghorn. Powdered succostrin was chosen because of researcher familiarity with the drug. Based on some immobilizing data using succostrin on penned pronghorn in Umatilla County, Oregon (Unpubl. data ODFW files) it was decided to start with a dosage of 6 mg and work up in 1 mg increments if necessary.

Immobilized animals were fitted with Telonics (Telonics, Inc., Tempe, AZ) transmitters with mortality signals and 9 month batteries mounted on breakaway collars (Trainer et. al 1981). Collars were designed to fall off in about 9 months after being placed on the animals. Collared animals were relocated once a month from February through July and once in September of 1983. Relocations were done using a Telonics TR 2 receiver and whip antenna mounted on a Cessna 172 airplane.

In March 1986, 10 adult pronghorn from the Duncan Reservoir herd were collared using a CODA 3 barreled net gun (CODA Enterprises, Mesa, AZ) fired from an Enstrom helicopter. The net gun was used because of the low number of animals needed, making the drive trap impractical, and use of the net gun on bighorn sheep indicated we could reduce the amount of helicopter time needed to put out the collars. Captured animals were fitted with Telonics transmitters mounted on strap collars provided by Telonics. Transmitters had 2-year batteries and mortality signals.

Collars were relocated monthly from either the ground or air. Ground relocations were done using a TR2 receiver and dual element Yagi antenna. Air

relocations were done using a TR2 scanning receiver with a Yagi antenna mounted on each wing strut (Gilmer et. al 1981) of either a Cessna 180 or a Piper Supercub.

RESULTS

Capture

In February 1983, 28 adult does were darted during 17 hours of helicopter time in the Fort Rock Valley (Table 1). Eleven of the does were immobilized, and of these, two died and nine were collared and recovered (Table 2). Over half of the flying time was spent working up the correct dosage for powdered succostrin. One animal was immobilized with 7 mg, but this proved an exception and we increased the dosage to 9 mg before getting successful immobilizations. All designated hits were made in either the backstrap or front or rear quarters. Because the darts were unbarbed, many of the darts bounced out after hitting the animal. Thius may have caused only a partial dose or no drug to be administered. Of the two antelope that died, one died of respiratory failure after being accidentally darted twice, the other died of heart failure apparently caused by the drug begin injected directly into the blood stream.

Table 1. Dosage and number of pronghorn antelope induced using Succinylcholine Chloride in the Fort Rock Valley, Oregon, 1983.

Dosage (mg)	Darts shot		Number Induced
	Hits	Misses	
6	3	0	0
7	3	2	1
8	3	0	0
9	19	3	10
Total	28	5	11

Table 2. Induction and recovery time for pronghorn antelope darted in the Fort Rock Valley, Oregon, 1983.

Dosage (mg)		Induction Time (min)	Time Until Recovery (min)
7		18	2
9		7	a
9		9	22
9		10	30
9		18	b
9		10	15
9		6	21
9		8	15
9		9	15
9		9	19
9		9	25
	x	10.3	18.2
	s	4.0	7.9

[a] Accidentally darted twice and died of respiratory failure.

[b] Defibrillated for 45 seconds - was dead 1 minute after defib started.

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In March 1986, 11 animals were captured in 7.4 hours of helicopter time using the CODA net gun. One animal died of a broken neck caused by the fall. Nine does and one buck were collared and released. In September 1986, two of the collared does died apparently of natural causes and these two collars were put on two new does in December 1986. The magnet was not removed from one of the transmitters, so a total of 11 different animals were monitored during the study.

Monitoring and Movement

All but two of the collared Fort Rock animals moved from the valley in late March 1983 and eventually travelled about 55 miles southwest to the Diamond Junction area west of Highway 97 (Figure 1). Of the two collared animals that did not go to the Diamond Junction area, one spent the summer in the Fort Rock Valley with a group of 12 animals and the other summered with 50 animals in the Cabin Lakes area north of the Fort Rock Valley. Migration was broken up into two parts. Animals moved south along 9-Mile Ridge, crossing Highway 31 south of Oatman Flat, then moved south and west, arriving on Antelope and Bear Flats by April. This part of the migration is about 28 miles through Juniper (Juniperus occidentalis) and sagebrush habitat. The animals spent April and part of May in the low sage (Artemisia longiloba), Sandbergs bluegrass (Poa sandbergii) areas on or near Antelope and Bear Flats. In mid-May the animals moved west from Bear Flat, passing through approximately 15 miles of cutover Ponderosa pine (Pinus ponderosa)/Lodgepole pine (Pinus murrayara) timber to the north end of Klamath Marsh, then west around the north side of the marsh to the summer range west of Highway 97. Vegetation on the summer range is stunted lodgepole and ponderosa pine with

bitterbrush understory and 20 percent canopy closure. North slopes in the area are logged over open stands of ponderosa pine and bitterbrush.

Fall migration was reverse of spring migration with animals arriving on Antelope Flat in September and returning to the Fort Rock Valley by late November or December.

All but two of the collared Duncan Reservoir pronghorn migrated to the area around Sycan Marsh for the summers of 1986, 1987, and 1988 (Figure 2). The two nonmigratory animals summered with a group of about 20 animals on the low sage/bunchgrass flats south of Duncan Reservoir. Migratory animals leave the winter range in late March and move south about 20 miles through cutover ponderosa pine/bitterbrush stands (20-40% canopy closure) and low sage-scab rock flats along the east side of Hagar Mountain and Foster Butte, entering the summer range on the northeast side of Sycan Marsh. Two of the collared animals moved north from Sycan Marsh with about 20 animals to the low sage-bunchgrass flats on the southeast side of Thompson Valley Reservoir along Benney Creek and Squaw Creek. The remaining seven animals summered with the rest of the herd on the meadow areas of Sycan Marsh and the low sage flats east and south of the marsh.

Unlike the Fort Rock herd, spring migration for the Duncan herd is very fast. On 24 March 1988, all the collared animals were still in the vicinity of Duncan Reservoir. During a flight on 29 March 1988, all the migratory animals were located in the vicinity of Sycan Marsh. Fall migration is slower and dependent on weather. In 1986, snow fell at higher elevations in September and by early October antelope were returning to the winter range. By

13 November, all but three collared animals were on the winter range. The fall of 1987 was very dry and mild with no early snows. By 29 October only one animal had returned to the winter range.

Winter counts on the Duncan herd have fluctuated between 500 and 650 animals. A reasonable population estimate for this herd would be 600 animals. No obvious area within the summer range was used for kidding. Pronghorn does used the large open flats available in the summer range for kidding.

DISCUSSION

Migration of pronghorn herds through forested habitats is not uncommon, especially in Oregon (Trainer et. al 1983). No other research could be found which reported pronghorn using open forested habitat for summer range as is the case with the Fort Rock herd. Whether this range was more typical pronghorn habitat at some time in the past is not known but there have been pronghorn sighted in this area since records have been kept by ODFW.

The reason for the Fort Rock study was to identify the herd range of a group of wintering animals that were involved in a damage problem. Options included emergency hunts in the valley, either sex hunts on summer range and migration range, cooperating on stackyard materials, and providing hazing and repellant materials. The general consensus of the landowners was that they did not want to see a major reduction in pronghorn numbers because they were the ones that put their alfalfa fields on the pronghorn winter range and appreciated observing the animals. ODFW, with assistance from Oregon Hunters Association, provided haystack protection, and landowners felt they could

continue to accept the animals wintering on their alfalfa fields. Two hunts were started based on the results of the Fort Rock study. Each of these are on summer range, with 30 either-sex tags and hunter success rarely exceeds 10%, which has little effect on population numbers.

Comparison of the use of drugs versus the net gun as a capture technique for antelope gives mixed results. If the proper dosage for succostrin had been available we could have reduced our helicopter time by an estimated 8 hours. At the time we used the net gun it was still a relatively new tool for our department, and with more experience and the new four barreled model currently in use, we should have used less than seven hours of helicopter time. Assuming you have an experienced gunner, the net gun should be a more efficient capture tool than succostrin for pronghorn. With the increased use of the Rompum/Ketamine cocktails, Captur-all 2 and 5, and Carfentanil (Jessup et. al 1986), use of succostrin for immobilizing large animals has decreased substantially. Use of these drugs for immobilization should reduce needed helicopter time due to their generally shorter induction times and the availability of the antagonists Yohimbine for the cocktails and Naloxone for carfentanil. Proper dosages for pronghorn using these two drugs could not be found in the literature and would need to be worked up before they could be used efficiently.

Cause for the increase in animals of the Duncan Reservoir herd is not totally evident. During the hunting season this herd is scattered between two management units. While in the Silver Lake Unit most of the animals are on the Nature Conservancy lands of Sycan Marsh where no hunting is allowed, and very few animals are taken around the fringes. Hunting seasons for the animals in

the Interstate Unit are restricted to 450 archery tags and 20 muzzleloader tags. Hunter success rarely exceeds 4% in the archery hunts and 15% on the muzzleloader hunts. This amount of harvest has little to no effect on the population. Several years of good recruitment attributable to the high quality forage of Sycan Marsh along with little harvest has helped this population.

Recruitment does not totally explain the increase of the Duncan herd from 150 animals in the mid-1970's to about 600 by 1986. There is some sketchy information that some animals from the Fort Rock herd may have shifted winter range to Duncan Reservoir and subsequently shifted summer range. During a flight in 1986 a signal of 151.460 megahertz, used in the Fort Rock study, was heard faintly and estimated to be located on the flats east of Sycan Marsh. The Fort Rock collars had 9 month batteries and this collar should have been dead. Not all the Fort Rock collars were retrieved. Although they were breakaway collars, either the batteries died prior to falling off or they started falling off during fall migration and were covered with snow. These batteries died before spring thaw. Denney (personal comm. 1988) felt some Fort Rock pronghorn were moving from Antelope Flat to Duncan Reservoir but none of the collared animals were ever located outside the Fort Rock migration route. Although movement of Fort Rock animals to Duncan Reservoir cannot be proved, it would be relatively easy for animals on Antelope Flat in the fall to move west 15 miles through Juniper-sagebrush habitat to the Duncan Reservoir winter range.

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AUM EQUIVALENCE AND ITS USE IN RANGELAND PLANNING

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In the past, AUM equivalence between domestic animals and big game species have often been measured by comparing gross forage weight intake by wildlife species for the month against what a cow consumes for the month (i.e. 800 lbs.). Diet similarity or overlap were often not evaluated. Neither was:

- forage diversity and quality of the range
- the time of overlap use
- the overlap in distribution of animals using a common range
- topography
- distribution of water sources
- condition of the range - especially during drought years
- animal behavior

We know from research findings over the last 20+ years that diets between pronghorn antelope and cattle are generally quite dissimilar on good condition range except for a short period during the spring when pronghorns utilize grass to a small degree. Assessment of range forage preferences for domestic livestock and antelope indicate that cattle, horses, and sheep are more dependent on grasses than pronghorn are. Domestic sheep consume more browse and forbs than cattle, but not as much as antelope. As long as all classes of forage are in adequate supply, significant competition between livestock and pronghorns would not be anticipated. Availability, however, of preferred forage species is not adequately abundant on many western public rangelands (USDI, Bureau of Land Management 1975 b). Competition for forage can be related to populations. Pronghorn populations have significantly

decreased over the last 100 years. It is estimated there are now about 1 million animals in western North America as compared to 40 million in the mid-1800s (Borland 1975). Domestic livestock numbers have filled that void. Pronghorns consume only a fraction of one percent of the forage today (Yoakum 1980).

Diet overlap between pronghorns and cattle generally does not significantly vary over the area inhabited by pronghorn:

- In NW Nevada on the Sheldon NWR - Hansen (1982) found 12% overlap
- In Central Oregon, Burns BLM District, 10%
- In South Central Wyoming on the Red Desert, 18%

Some exceptions have been found in SE New Mexico on the southern short grass prairie where diet overlap ranged from 29% to 58%.

Research findings used over the last 40 years, however, show tremendous variation in AUM equivalencies between pronghorn and livestock.

I'll discuss cattle first:

- Hoover (1959) in Colorado found 105 antelope = 1 cattle AUM on good condition range
- Anderson (1978) in Idaho found 59 antelope - 1 cattle AUM
- Buechner (1947) in Western Texas found 38 antelope = 1 AUM
- More recently studies in the Burns and Boise BLM Districts show 7 to 14 antelope = 1 cattle AUM
- Montana BLM uses 5 antelope = 1 cattle AUM

For domestic sheep:

- Taylor (1975) in the Red Desert, Wyoming found 9.4 antelope = 1 sheep AUM

- On short grass range in Colorado it was found 7 antelope = 1 sheep AUM

This wide variation in AUM equivalences can probably be attributed to the different methodology and basic data used. Some authors considered diet overlap, volume of forage consumed, overlap in distribution of ranges, condition of ranges, etc.; others may have used only some of the factors.

The difficulty of accurately assessing AUM equivalencies and allocating forage between domestic livestock and big game species is still with us. There is little agreement between federal agencies, districts within the Bureau of Land Management, and State Wildlife Departments.

What does it mean for Rangeland Planning? In most of the western states, determining AUM equivalency is left up to each individual district and their counterpart in the State Wildlife Agency. BLM state offices for the most part are not sending out guidelines that districts must follow. The trend is away from standardization of AUM equivalency. This is probably due to several reasons:

The great variability in condition of rangeland habitats, livestock stocking rates, climatic factors.

Also, and probably of greater importance, is that forage allocations are not being made in most current BLM Land Use Plans. From about 1975 to 1983, when Grazing Environmental Impact Statements were written, forage allocations were made. However, since 1983, Resource Management Plans are being written that provide for Land Use Allocations rather than forage allocations.

Identification of big game population management objectives and identification of high priority habitat use areas are required. Because livestock grazing is the primary use on 98% of the BLM rangeland, land use allocations made on critical habitat areas are now being given greater consideration than forage allocation in Land Use Planning Processes.

Activity Plans such as Grazing Allotment Management Plans and Habitat Management Plans, which are on a much smaller scale and more site-specific, however, still address forage allocation.

Forage allocations are meaningless until we properly stock ranges according to the current condition and site capability. Currently we stock livestock based on acreage of the pasture or allotment and not necessarily on its suitability to livestock grazing or the condition of the range and water availability. Slopes over 35-40% are underutilized by cattle on most ranges, but are still figured into the stocking rate.

Grazing Allotment Plans that seriously incorporate and carry out objectives to manage for a diverse and healthy native plant community that considers all herbivores rather than a forage allocation would go a long way in providing both an increase in quantity and quality of suitable habitat for antelope.

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Discussion on AUM Equivalence and Use in Rangeland Planning

BLM state offices for the most part are not sending out guidelines that districts must follow. I canvassed BLM state offices in Colorado, Montana, Idaho, Wyoming and Oregon. Only Idaho has sent out guidelines for figuring out the equivalencies.

This trend away from standardization of AUM equivalency is probably due to several reasons. The great variability in rangeland condition, livestock stocking rates and climatic factors. Also, and probably of greater importance, is that forage allocations are not being made in the current BLM land use plans in a lot of the states. Talking to Colorado, they said forage allocation doesn't mean anything. What's happened in the bureau since about 1983, from about 1975 to 1983, is that forage allocations were made as we were doing grazing statements. That was one of the requirements. Since 1983 we've gone through real broad-based planning that does not call for forage allocations. Now we are doing land use allocations. In the resource management plan we probably will look at forage allocation on smaller, more site specific areas. So, actually forage allocation doesn't mean much anymore in the BLM, at least not at the broad-based resource management plan level.

Q. If we were going to increase the animal numbers, elk numbers or something like that on BLM winter range, do you mean the Bureau wouldn't be saying much as far as there being enough or not enough forage out there for the domestic livestock that are permitted ...

A. Kniesel Yeah, it's going to say something then. But, right now a lot of the state's forage allocation is such a hard thing to determine and actually get it implemented on the ground that we're just going to ignore him. But I think that's something that's got to be tested, and I think it's up to the state game and fish agencies to start pushing us. What are we going to do with the excess forage? If there is excess, are we going to allocate it to wildlife? I think we'll probably deal with those things on more site-specific area plans.

Sadowski: ... at least in northern and southern areas of the Vale BLM district we did have an allocation for big game that's been done a couple of different times. To my knowledge we've carried that forward to the whole land use process, so that right now whatever we determine the AUM demand for antelope or mule deer is still built into the land use plan. Where you have established grazing systems for livestock operation, you set up a grazing system you believe will meet your objectives. After a five-year period you reevaluate that grazing plan and at that time you take a look at those AUM's again, and try to figure out whether or not you are meeting your objectives. Our wildlife specialist is supposed to interact in that whole process and make sure that we're talking with our counterparts in the Fish and Game Department to insure the game is getting their fair share. So, I'm not quite sure I agree with you it's not important anymore, but it's got a little different complexion.

Kniesel: You see tremendous variability throughout the Bureau on this. The people I've talked to in Colorado especially; they don't even mention it in their last three resource management plans. The word I'm getting from talking to those people is that forage allocation isn't a big issue anymore. How they're dealing with the changes, I'm not sure.

Kaschke: We're up against the same thing here on the refuge, especially Sheldon, when we set up a plan down there. There was a push for forage allocation, and we felt that had some problems. So we approach it more on a basis of identified antelope use areas, whether it's summer range, winter or whatever, and then we develop our livestock prescriptions trying to meet our objectives; i.e. whether we wanted to increase our antelope and if there was something we could do with changing the livestock use. I certainly agree that it's much more logical to approach it on a habitat use basis of the animal rather than on the big broad scale.

Kniesel: I think a lot of people in the Bureau were just going through a paper exercise. When you look at the variability presented here; anywhere from 105 antelope per AUM down to where Montana is using five antelope per AUM; I mean that's a helluva variability. Is that variability due to the methodology they are using or the formula they are using? Or is it just a wild guess? Also, how were we monitoring? We don't have the personnel to monitor. I would agree with Marv that a more rational approach would be to look at what the animal is telling us.

I think we really need to look at a lot of different techniques; This year's a good year with the drought we've got in large parts of the west; we or the game and fish agencies need to start pushing us in the Bureau to start looking at a drought year so that we don't keep cows on until there's absolutely nothing left. The same with water sources. All these AUM equivalencies don't mean a lot in a drought year. You've got to deal with it on an individual basis, and I think the game and fish agencies really need to keep on top of us as far as what happens during a drought year. Is wildlife going to be considered or is anything going to be left alive at all? I know that is what has happened in my resource area. Some of the other BLM biologists say the same thing. Wildlife took it in the shorts. But I think the game and fish agencies have to be on top of us and start putting the pressure on us at all levels - district and state office levels.

Pronghorn Habitat Preference

In Southeastern Oregon

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ABSTRACT

During summers of 1981 and 1982, radio monitoring and visual observation were used to document habitat preference by pronghorn (Antilocapra americana) in southeastern Oregon. Fawns and does demonstrated the greatest preference for the early low sagebrush (Artemisia longiloba)/Idaho fescue (Festuca idanoensis) vegetation type at both Jackass Creek and Bear Valley study areas. Bucks preferred the silver sagebrush (A. cana var. bolanderi)-playa type at Jackass Creek and silver sagebrush (A.c. var. viscidula)-dry meadow type at Bear Valley. Big sagebrush (A. tridentata), western juniper (Juniperus occidentalis), and wet meadow types were avoided by pronghorn. Habitat with low shrub volume was strongly selected by all categories of pronghorn. Ninety-one percent of all fawn locations had shrub volumes less than 32 m^3. Conversion of big sagebrush habitat can benefit pronghorn if consideration of diversity and juxtaposition of vegetation types are included in the project.

Pronghorn (Antilocapra americana) habitat in southeastern Oregon is primarily on Bureau of Land Management (BLM) rangeland and is typified by Harney County where BLM holdings constitute 50% of the 26,497 km^2 county. Although mostly native range, 4% of the Harney County BLM lands were converted to seedings, predominantly crested wheatgrass (Agropyron cristatum) during the period of 1950-82 (F. Taylor, pers, comm.). Likewise, some private land (27% of the county) has been recently subjected to these conversions. To document pronghorn and particularly fawn preference for various plant communities, an examination of habitat relationships was part of a research project addressing causes, amount and timing of pronghorn fawn mortality. The studies were undertaken in response to declining August fawn:doe ratios (Trainer et al. 1983) in southeastern Oregon.

The purpose of this paper is to document summer habitat preference of pronghorn in southeastern Oregon, contrast habitat use by pronghorn in areas of high and low productivity, and provide suggestions for habitat improvement.

STUDY AREAS

Two locations were selected for this study: Jackass Creek and Bear Valley. The Jackass Creek study area, encompassing 340 km^2, is located 60 km south of Burns in Harney County, Oregon. Topography includes gently rolling uplands broken by occasional rims and predominantly dry creek beds. Elevation varies from 1,464 to 1,708 m. Vegetation is dominated by shrubs, principally Wyoming big sagebrush (Artemisia tridentata var. wyomingensis) and early low sagebrush (Artemisia longiloba). There are a few scattered western juniper (Juniperus occidentialis) stands on the east and south boundaries. The most

abundant grasses are Sandberg's bluegrass (Poa sandbergii), bottlebrush squirreltail (Sitanion hystrix), and wheatgrass brome (Bromus tectorum). Waterholes developed along the ephemeral creeks retained water during the years of the study. Fawn survival, as measured by August herd composition, was relatively low (1969-82 $\bar{x}$ = 21 fawns:100 does, Trainer et al. 1983).

The Bear Valley study area is located 72 km north of Burns in Grant County, and encompass 185 km^2. Elevation in the valley ranges from 1,404 to 1,511 m. Many low, sloping hills are scattered through the valley. Approximately 20% of Bear Valley has been converted to seedings, predominantly crested wheatgrass/alfalfa (Medicago spp.). The remainder of the study area is comprised of shrub and meadow communities. Mountain big sagebrush (A. t. var. vaseyana), green rabbitbrush (Chrysothamnus viscidiflorus), and early low sagebrush are the most abundant shrubs; Sandberg's bluegrass, prairie junegrass (Koeleria cristata), and Idaho fescue (Festuca idahoenis) are the most common grasses. Pronghorn were not reported in Bear Valley until 1957 when 8 were observed (A.R. Polenz, unpubl. Rep. Ore. Dep. Fish and Wildl. 1972.). The population grew to 456 by 1976. High fawn survival rates prevailed (1969-82 $\bar{x}$ = 74 fawns:100 does, Trainer et al. 1983).

METHODS

Habitat preference by pronghorn bucks, does, and fawns was determined by comparing the relative use of vegetation types with the availability of each type for each study area. Habitat use data were assembled from radio locations of fawns and visual observations of fawns and adults during all daylight hours, May through September. Radio locations were determined from

144 fawns (60 at Jackass Creek and 84 at Bear Valley) at 8 to 12 day intervals in 1981 and 1982. Visual observations were made randomly for fawns in 1981. Observations of bucks, does, and fawns were obtained from survey routes systematically distributed through the study areas in 1982. Routes were traversed by vehicle or horseback using binoculars and spotting scopes to locate pronghorn. For each observation the vegetation type, pronghorn sex and age composition, and location were recorded.

Vegetation of each study area was typed by ground truthing photo interpretation classes. The area of each stand of vegetation was calculated from final delineations on aerial photographs by a digital planimeter, and then summarized for each type and area. Vegetative descriptions for all vegetation types were developed from measurements taken at fawn-use sites and at representative locations in unused types. Plant nomenclature follows Hitchcock and Cronquist (1973) and Garrison et al. (1976). At each location, a 400 m^2 macroplot was established, and at fawn-use sites canopy coverage of grasses and forbs was estimated from replicated microplots (Daubenmire 1959). Shrub cover was measured along a 20 m line intercept (Canfield 1941). Mean shrub height was determined from measurements of shrubs taken every 2 m along the intercept line.

Shrub volume, the volume of shrubs in a macroplot, was first used by Pyrah (1974). We calculated shrub volume (SV) of 400 m^2 macroplots as follows:

$$SV(m^3) = \text{Shrub cover } (\%) \times 400(m^2) \times \text{Shrub height}(m)/100.$$

Shrub volume provided an indication of both visibility and ease of movement in shrub habitat.

Preference indices were calculated by dividing the proportion of observations in each vegetation type by the proportion of the study area in that type. Relative preference index (R.P.I.) values theoretically ranged from 0 (least preferred), through 1 (used in proportion to occurrence), to infinity (most preferred). Chi square analysis was used to determine if pronghorn categories (bucks, does, fawns) utilized vegetation types in proportion to their occurrence and contingency table analysis was used to determine if categories of pronghorn used vegetation types different from each other. The number of animals seen in each vegetation type was used as the observed value, and expected values were calculated by multiplying the proportion of each vegetation type available by the total number of pronghorn (bucks, does, fawns) observed in all types. Preference or avoidance of each vegetation type also was determined by calculating a 90% family confidence interval for the proportion of pronghorn observed in each type and comparing it to the proportion of that type available (Neu et al. 1974). For vegetation types with few observations, preference may not be indicated by this method, even if the calculated relative preference index is reasonably high.

Fawn habitat preference at Jackass Creek was calculated from fawn-use site data because those data were far more extensive (N = 97) than that available from survey routes (N = 10) due to high fawn mortality at Jackass Creek (Trainer et al. 1983). Higher fawn survival provided an adequate number of fawns for observation at Bear Valley. Relative preference indices were therefore calculated for fawns using data from both survey routes (N = 657) and fawn-use sites (N = 229) at Bear Valley.

Home range areas were calculated for radio-collared fawns by the convex polygon method, and adjusted to compensate for sample size bias using information presented by Jennrich and Turner (1969) and modified by Trainer et al. (1983).

RESULTS

Stand Size

The mean size of stands for different vegetation categories was larger at Jackass Creek than at Bear Valley for all categories common to both study areas (Table 1). Agricultural and meadow types were not available at Jackass Creek and playas were not present at Bear Valley. Mean stand size at Bear Valley was significantly ($P < 0.05$) smaller than at Jackass Creek (25.0 vs. 43.4 ha).

Habitat Preference

Fawns at Jackass Creek used vegetation types disproportionate to their availability ($X^2 = 46.46$, $P < 0.005$) (Table 2). Highest fawn preference was demonstrated for the early low sagebrush/Idaho fescue vegetation type (R.P.I. = 2.06) even though the proportion of their occurrence in this type was not statistically significant because of a low number of observations. Preference ($P < 0.10$) was, however, demonstrated for the early low sagebrush types collectively. Mosaics of Wyoming big sagebrush-early low sagebrush were also preferred ($P < 0.10$), but were not utilized extensively until after mid-July. Preference was lower among the other vegetation types with two categories, western juniper and silver sagebrush-playa, unused (Table 2).

Doe use of vegetation types at Jackass Creek was disproportionate to availability ($\underline{X}^2$ = 256.6, $\underline{P}$ < 0.005) (Table 3). Does, like fawns, demonstrated the highest preference ($\underline{P}$ <0.10) for the early low sagebrush/Idaho fescue type (R.P.I. = 3.01) and completely avoided the western juniper type (R.P.I. = 0.0).

Bucks also showed disproportionate use of vegetation types ($\underline{X}^2$ = 43.71, $\underline{P}$ < 0.005) (Table 3). Bucks demonstrated a significant preference ($\underline{P}$ < 0.10) for early low sagebrush types collectively, and the early low sagebrush/Sandberg's bluegrass-bottlebrush squirreltail type in particular. Unlike does and fawns, bucks demonstrated a high preference for the silver sagebrush-playa type (R.P.I. = 1.90). Wyoming big sagebrush/Sandberg's bluegrass-bottlebrush squirreltail was the type most avoided by bucks (R.P.I. = 0.21).

Pronghorn collectively used vegetation types in a manner disproportionate to availability ($\underline{X}^2$ = 259.69, P < 0.005) and also different from each other (X^2 = 57.31, $\underline{P}$ < 0.005> (Table 3). They exhibited the highest preference ($\underline{P}$ < 0.10) for the early low sagebrush/Idaho fescue type (R.P.I. = 2.43), and avoided ($\underline{P}$ < 0.10) the juniper type (R.P.I = 0.08).

Fawns at Bear Valley most preferred ($\underline{P}$ < 0.10) the early low sagebrush/Idaho fescue type (R.P.I. = 4.18) and avoided ($\underline{P}$ < 0.10) wet meadows (R.P.I. = 0.09) (Table 4). Does followed the same pattern for the above types. Bucks highly preferred ($\underline{P}$ < 0.10) the silver sagebrush-dry meadow type (R.P.I. = 3.79) and avoided ($\underline{P}$ < 0.10) wet meadows to a greater extent than does and fawns (R.P.I. = 0.04). Fawns, does, bucks and pronghorn collectively

used vegetation types in a manner disproportionate to availability (X^2 = 800.84, 1130.84, 243.62, and 2,100.44, respectively, $P < 0.005$ inclusive). Pronghorn collectively exhibited the highest preference ($P < 0.10$) for early low sagebrush/Idaho fescue (R.P.I. = 4.17) and avoided wet meadows (R.P.I. = 0.11). Sex and age categories of pronghorn also used habitat in a manner different from each other (X^2 = 74.86, $P < 0.005$). Preference indices calculated from fawn-use site data, 1981 and 1982, were similar to those calculated from survey route data (Table 4). Early low sagebrush/Idaho fescue was highly preferred (R.P.I. = 2.91) and wet meadows and mountain big sagebrush/Idaho fescue types were avoided (R.P.I. = 0.29 and 0.51 respectively).

Shrub Volume

Habitat use by pronghorn fawns in both study areas was highest in vegetation types with low shrub volume (Tables 3, 4). At Jackass Creek, 67% of the fawn-use sites during 1981 and 1982 were in early low sagebrush types with a mean shrub volume of 17.0 m^3. Only 4% of the use at Jackass Creek occurred in Wyoming big sagebrush types ($\bar{x}SV = 59.8m^3$). At Bear Valley, agricultural and meadow types had mean shrub volume of 4.3 and 2.8 m^3, with 33 and 27% of the use, respectively. Shrub volume of use sites was significantly ($P < 0.10$) lower than for random sites in all major vegetation types measured for both study areas.

On each study area, 91% of all fawn-use sites had shrub volume less than 32 m^3, and approximately 75% of the sites had shrub volume less than 24 m^3. Mean shrub volume of use sites at Bear Valley (11.3 m^3) was significantly

($P < 0.05$) less than at Jackass Creek (21.4 m^3), principally because there was substantially more habitat of low shrub volume available at Bear Valley. For example, meadows and seedings were available at Bear Valley with shrub volume at or near 0.0 m^3; however, at Jackass Creek the vegetation type with the lowest shrub volume was early low sagebrush/Idaho fescue (S.V. = 15.6 m^3).

DISCUSSION

The Bear Valley study area had greater diversity of vegetation types and plant species and greater juxtaposition of vegetation types and water. These characteristics provided life requirements for pronghorn fawns within smaller summer home range areas at Bear Valley (555 ha) compared to Jackass Creek (1,233 ha). Reduced travel may have benefitted Bear Valley fawns by making them less vulnerable to detection by predators.

Some vegetation types provided habitat quality of an ephemeral nature. Wet meadows at Bear Valley were avoided early in the season due to flooding, but were used more frequently after they had dried and were hayed in July-August. Wyoming big sagebrush types, as found in mosaics at the Jackass Creek area, received little use by pronghorn until mid-July. Shade during mid-day and increased moisture content of plant species in big sagebrush types during mid and late summer probably caused pronghorn to shift to these mosaics. Bodie (1979) found that big sagebrush vegetation types in Idaho had a higher forage moisture content than low sagebrush types in early July and observed a shift in doe and fawn use from low to big sagebrush vegetation types in June and July. Good and Crawford (1978) reported that the use of playas in southeastern Oregon was positively correlated with soil moisture.

Vegetative structure was probably the most important habitat characteristic selected by pronghorn during summer. Even though the use of vegetation types by fawns was different between study areas due to differences in availability, the shrub volume of use sites remained within the same range for each study area (91% of all sites used had shrub volumes < 32 m^3). Fawns consistently used vegetation types which provided low shrub volume. The most preferred native vegetation type at Bear Valley and also at Jackass Creek was early low sagebrush/Idaho fescue which had low shrub volume (15.6 and 20.5 m^3 respectively).

Big sagebrush types were used disproportionately between study areas. Mountain big sagebrush types at Bear Valley were used 19% of the time, whereas at Jackass Creek, Wyoming big sagebrush types were used only 4% of the time. We believe the difference in shrub volumes (24.8 m^3 at Bear Valley vs. 59.8 m^3 at Jackass Creek) was largely responsible for the difference in frequency of use between areas.

Other studies that investigated habitat characteristics reported similar results. Sundstrom et al. (1973) summarized the use of 27 vegetation types in pronghorn range of North America. Photographs showed that this habitat had low shrub volume. Pyrah's (1974) study in Montana found a mean shrub volume of 20 m^3 for fawn sites and 89% of the sites were less than 31 m^3. McNay (1980) found a mean shrub volume of 10 m^3 for fawn bed sites in Nevada.

MANAGEMENT IMPLICATIONS

The increase in big sagebrush conversions to crested wheatgrass seedings has generally been met with favor by livestock operators. The principal benefit to livestock is in increased AUM's of forage.

Wildlife biologists in southeast Oregon have expressed mixed reactions to converting sagebrush to crested wheatgrass seedings. Reeher (1969) concluded that ranges in southeast Oregon with low pronghorn use or with winter use could be enhanced for pronghorn by plowing and seeding. Yoakum (1980) suggested that sites in poor vegetative condition, but with the right combination of other habitat factors were suitable for forage improvement projects. He also felt that extensive areas of dense, tall brushland (high shrub volume) could be manipulated to enhance pronghorn habitat. Kindschy et al. (1978) described the importance of low vegetative structure and suggested that crested wheatgrass stands with dryland alfalfa were satisfactory in structure and were acceptable habitat if in proper juxtaposition with water and winter ranges.

The results of this study indicated that agricultural areas in general and crested wheatgrass seedings (with alfalfa) in particular, when in moderate size (Bear Valley $\bar{x}$= 37.55 ha/occurrence and number (15.2% of the study area) were used about in proportion to availability during spring and summer. We believe that conversion of big sagebrush habitat with high shrub volume to habitat with increased juxtaposition and decreased shrub volume can be beneficial to pronghorn. These conversions can alleviate grazing pressure by livestock on the preferred native ranges if AUM's are not increased, by

concentrating their use on the seedings. However, unless careful planning and monitoring are instituted by cooperators, we feel that continued extensive conversion of native ranges may be detrimental to pronghorn by ultimately decreasing the desired diversity and juxtaposition of vegetation types. Sagebrush is also a very important component of pronghorn diet in southeastern Oregon, making up 60% of yearlong diets and 83% of September-March diets (Mason 1952). Continued extensive conversion could therefore reduce carrying capacity of pronghorn.

The calculation of shrub volume is a simple technique for estimating the value of shrub-steppe rangeland for pronghorn. It lends itself well to evaluating proposed vegetation conversions on existing pronghorn ranges as long as stand size placement is also considered. The data indicated that a shrub volume of about 31 m^3 represents the high end of pronghorn use, and less that 24 m^3 is desirable.

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Table 1. Mean stand size of vegetation types at Jackass Creek and Bear Valley study areas, southeastern Oregon, 1982.

Category[a]	Area (ha)/Occurrence	
	Bear Valley	Jackass Creek
Agricultural	40.7	
Low sagebrush	6.4	47.1
Big sagebrush	22.4	35.6
Mosaics of low and big sagebrush	34.6	55.4
Meadow	20.6	
Playa		44.7
Juniper or Forest	31.5	35.2
Mean	25.0	43.4

[a]Categories are comprised of several vegetation types.

2-R-220

Table 2. Preference indices of vegetation types used by pronghorn fawns (N = 97) as determined from fawn use sites on Jackass Creek study area, Harney County, Oregon, 1981 and 1982.

Vegetation type	% of Area Available	Preference Index
early low sagebrush-spiny hopsage (*Atriplex spinosa*)/Sandberg's bluegrass-bottlebrush squirreltail	21.98	1.27[a]
early low sagebrush/Sandberg's bluegrass-bottlebrush squirreltail	19.58	1.58[a]
early low sagebrush/Idaho fescue	2.50	2.06[a]
early low sagebrush/Thurber's needlegrass (*Stipa thurberiana*)	4.94	1.04[a]
LOW SAGEBRUSH SUBTOTAL	49.0	1.41
Wyoming big sagebrush/Sandberg's bluegrass-bottlebrush squirreltail	24.37	0.17
mosaics (early low and Wyoming big sagebrush)	14.38	1.86
western juniper	2.38	0.00
silver sagebrush and playa	7.95	0.00

[a] Preference or avoidance not indicated ($P > 0.10$) (See Neu et al. 1974).

2-R-220

Table 3. Preference indices of vegetation types used by pronghorn (N = 496) as determined from survey routes and mean shrub volumes for fawn-use sites on Jackass Creek study area, Harney County, Oregon, 1982.

	Preference Index			Total Pronghorn	$\bar{x}$ Shrub Volume (m^3)
	Bucks	Does	Fawns		
early low sagebrush/ Idaho fescue	0.67[a]	3.01	2.01[a]	2.43	15.6
early low sagebrush/ Sandberg's bluegrass-bottlebrush squirreltail with spiny hopsage and Thurber's needle grass	1.41	1.54	1.72	1.51	17.1
LOW SAGEBRUSH SUBTOTAL	1.35	1.67	1.75	1.59	17.0
Wyoming big sagebrush/ Sandberg's bluegrass-bottlebrush squirreltail and other grasses	0.21	0.10	0.00	0.13	59.8
western juniper	0.35[a]	0.00	0.00	0.08	--[b]
silver sagebrush and playa	1.90[a]	0.14	0.00	0.55	28.7[c]

[a] Preference or avoidance not indicated (P >0.10) (See Neu et al. 1974).
[b] No measurements taken.
[c] Representative site mean. No fawn use in this type.

2-R-220

Table 4. Preference indices of vegetation types used by pronghorn (N = 1831) as determined from survey routes and mean shrub volume for fawn-use sites on Bear Valley study area, Grant County, Oregon 1982.

Vegetation Types	% of Area Available	Preference Index			Total Pronghorn	$\bar{x}$ Shrub Volume (M^3)
		Bucks	Does	Fawns		
young and mid-aged crested wheatgrass seeding	11.86	1.46[a]	0.60	0.59	0.72	2.6
old crested wheatgrass seeding	3.36	0.56[a]	1.31[a]	1.13[a]	1.14[a]	11.0
smooth brome (Bromus inermis) seeding	1.44	2.09[a]	1.22	1.58[a]	1.48[a]	4.8
nurse crop (rye, Secale cereale), plowed, fallow	2.68	1.96[a]	1.85	1.82	1.85	0
AGRICULTURAL SUBTOTAL	19.34	1.42	0.95[a]	0.93[a]	1.01[a]	4.3
silver sagebrush-dry meadow	1.19	3.79	0.65[a]	0.76[a]	1.15[a]	3.8
dry meadow-some with other shrubs	15.49	1.55	1.79	2.00	1.83	0.5
wet meadow	19.53	0.04	0.14	0.09	0.11	0.0
MEADOW SUBTOTAL	36.21	0.81	0.86	0.93[a]	0.88	2.8
early low sagebrush/Idaho fescue and other grasses	7.43	3.39	4.40	4.18	4.17	20.4
mountain big sagebrush/Idaho fescue with other shrubs and grasses	37.04	0.49	0.48	0.47	0.48	24.8

[a] Preference or avoidance not indicated (P>0.10) (see Neu et al. 1974).

Variation in Mating Systems of Pronghorns

Bart O'Gara, U.S. Fish and Wildlife Service, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana

I know what John Byers was going to talk about here. It's an interesting situation, but I don't know all the details. I've reviewed his papers and have talked to him about it some. I think he was just going to talk about the population on the national bison range, which was one of the first territorial populations that was studied. A lot of what we know about territoriality in pronghorns was learned right there by Bromley and Kitchen.

In the predation talk I gave the other day, I mentioned having a bad winter in 1978-79, and at that time coyote predation had resulted in a very old age pronghorn herd. I don't remember the exact figures, but I think that winter it died back from about 139 to 79. I picked up most of the carcasses. They were practically all bucks, five years old or older and a few fawns.

This skewed the population to a very few older bucks. Generally they become territorial at three years of age. There weren't many young bucks because of the predation; we had low fawn survival for a number of years, so with only a few old bucks being territorial, and trying to hold a bachelor herd there, the younger bucks encroached on them a lot and there was a lot of fighting and a lot of chasing etc., and the does simply left the territories. Most of the breeding took place in fence corners where a young buck could hold the doe for a few days, breed her and go find another one. The whole territorial system broke down.

Well that isn't too surprising and I think this may have happened in some heavily hunted populations in some areas. I think I saw some of it in the Pahsimeroi in Idaho where there were territorial pronghorns at one time, and later on they were no longer territorial.

The interesting thing here is now that population is built back to a fairly normal structure and the territoriality has not came back. It seemed like they got into this system of random breeding. It's not even a real good harem-breeding situation. It's a great amount of chasing and running and lot of very young bucks breeding. They've never worked back into the territorial system since. I don't know what Johns' conclusions were going to be, but I do know that this was what he was going to talk about.

Panel Discussion: Variations in Capture Methodology and Translocation Objectives

Bart O'Gara (MT), Ray Lee (AZ), Bud Pyshora (CA),Rich Guenzel (WY), Tom Pojar (CO), Don Wilt (OR)

Bart O'Gara: I really never do anything I can get someone else to do, so I'm gonna' let the people on the panel introduce themselves, where they're from, maybe what their qualifications are to talk about trapping and transplanting and say a few words.

I've been trapping pronghorns for quite a while and I keep learning new things. One of the things I keep relearning is that they are easy to kill. I really think when we're talking today, we should talk about our failures as well as our successes, because people can learn as well from one as the other. It's always fun to talk about the time we caught 320 and two died and everything went lovely and so forth. It isn't as much fun to talk about the others.

Are the present trapping translocation guidelines adequate? Do the managers want more? I'll respond to that right now myself, my idea on it. I think what's there is real good. I think it's a good run-down on trapping with the large corral-type traps. We have someone here who'll talk about some improvements for that to

make them more affordable. And, as far as using tangle nets, what we have is pretty good. There is nothing there on drugging or net guns. These aren't techniques that have been used very much in transplants. Some people here have used net guns on pronghorns. Barrett was one of the first ones. I would encourage you very much if you have a three-barrel gun; pull the three barrels off, throw them away and get a four-barrel gun.

There's a real temptation that I fell into when they came out with the four-barrel gun. They came out with much lighter nets that had only about hundred-pound test crossbars in it. They shot fast, reached out and I really liked them. I used them on the ground for taking animals at waterholes and that sort of thing. But when I went out in the chopper and took pronghorns those little thin lines just skinned them. Boy, it looks like you've got shaved animals when they hit those little lines at about 50 miles-an-hour.

There is one problem if you wait until late in the season when the animals are herding up. Whenever you chase them you've got a hundred does up front, and you've got 50 bucks behind them that are where they're easy to take. If you try to fly over the bucks and split them away from the does you won't believe what happens. There's the damndest dodging and fish-tailing and running around, you can't hardly hit anything. You settle down between the bucks and the does, and the bucks will hit your helicopter; bang, bang, bang. They'll run right through it if they have to, to get back

to the does. So it doesn't work to split herds very well. I did find by pushing the top weights in pretty deep, you can shoot a net over the bucks and get it to settle on does pretty nicely. It sets your shoulder back a little more because your setting them pretty deep and the recoil increases considerably. You do it a lot and you probably want to check the bolts on the top of your gun.

I think if I was taking pronghorns in any numbers with a net gun I would sure wait and get just the right conditions, and that would be as much loose snow as I could get. When they tumble they lose hair and hit rocks. Do not double on them. When you hit two pronghorns and they're both going 50 miles an hour, hair and feet and everything else flies. I took a few that way and I quit it completely. Try to take single animals. It is the most selective method I know for taking the sex and age class you want and taking a couple from this drainage and a couple from that drainage; that sort of thing. Where animals are very scarce or very scary, it really works.

I'll say just one thing on drive netting. Pronghorns are harder to get to hit a net than any other animal. You want your chopper pilot to stay right on them, right into the net because if they start to turn the whole herd will turn like a school of fish. It's amazing how they can turn from a net. I learned one other thing the hard way this year. I was trying to take seven particular pronghorns and when you start to take some particular animals it

gets tough with anything but a net gun. These were animals that got out of the Bison Range and we wanted to get them back in. They're along a fence line; everything looked perfect to put kind of a double set of C-configuration nets on the fence, bring them along over the hilltop and into it. While we're doing it, the damn things walk out into the flat and they see us up there and there was no way of even getting close to them. It just amazed me that they know what is about to happen. I wouldn't have believed it if it hadn't happened.

Just a little bit about darting. People have tried to dart pronghorns for a long time. I think Don Beale is probably the first one that had any luck using sucostrin. Generally, people have gone away from that drug because you have a pretty narrow dosage range with individual animals with sucostrin. M99 has been used and it works very well on pronghorns, but it takes so damn much you need such a large dart, and that's a real problem with the small-boned, thin-skinned little animals. I tried 200 mg of Rompun. A 2cc dart will put a buck down and then if there's a herd around you'll never get him because he can appear to be out cold, and when the herd moves as you move in he'll go with them. He'll get up and stagger and everything else, but you will never get a hand on him because the more he runs the more he comes out of it. When carfentanil came out I thought hey, here's the perfect drug. Three times the potency of M99 and with 3 mg per cc you can get down to the one cc dart. I took five bucks in the spring just to see how it would work with 2-1/2 mg of carfentanil

and 50 mg of Rompun. It put them down in about two minutes. We handled and weighed them and didn't keep them out long. I'm kinda' stingy. I don't like to use new things so I used up my old M5050 I had left from when I used the M99 - reversed and gave 8 mg of M5050 per mg of carfentanil, half IV and half IM. They came out of it and everything worked lovely. I tried a straight three mg of carfentanil; just what would go in one cc dart. One pronghorn didn't go down but ran into another buck's territory and that buck killed him. Another one went down after about 10 or 12 minutes and we had to restrain him by hand. I think you do need the tranquilizing effect of something with the carfentanil. Now everybody tells me the naloxone is much better. It is approved for humans too, so it's probably a good thing to carry when you're handling these dangerous drugs, in case of an accident. Another thing, from my experience I would advise to not try to dart them during the rut. Now I've taken mountain sheep during the rut and I gave them about four times the dose to put them down and never had any trouble. I tried to take some animals off the Bison Range and I thought well, the rut's starting I better not take anything out of herds. I found an old doe off by herself about a mile from any other pronghorns. I hit her and for about a minute she staggered a little and here comes a buck 50 miles an hour from a mile away and tried to mount her. She tried to run; they ran about three miles and she went down and died. I should have known better. It made me a little bit mad so I darted the buck. As soon as he staggered here comes another buck from clear off someplace I hadn't seen. The darted buck was just about to go

down so I ran out there. I figured I'd keep the other buck away from him, but I couldn't. If you have never tried to keep a buck away from one that's down, it's damn near impossible. He horned him several times pretty bad. He died the next day. He came out of it with naloxone all right. Since that time John Byers has used carfentanil in marking some pronghorns and he's had some deaths too with the naloxone. I don't know if it's a difference in the antagonist; it's possible. When I first used M99 on mountain sheep with the antagonist the first half, we had bad luck. I killed two pronghorns with it, also. When we got the M5050, that turned around and worked.

My name's Ray Lee for those of you who don't know. I'm with the Arizona Game and Fish Department and I am their Chief of Game Management. In the last four or five years I've had the opportunity and probably nothing like these gentlemen, since we don't have the antelope populations, but we've trapped and released about 800 antelope. The majority of the times we've been going to other states. This has given me the opportunity to see how other states do their capture operations. I can only tell you that each state does it differently. I went through the guidelines that were passed out; I'm sure everybody else has because they've used very similar techniques. You go to a place like Colorado; they'll have a trap-net, or a trap set-up where they run the antelope in and then they'll fire a charge and drop a net on the antelope within the trap. This was new, it seemed to work pretty well. Texas runs them into a little bit different

corral. They put'em in a corral and then they'll have their holding chute off to the side and run the antelope into that. That also seemed to work. Okay, went to Wyoming. Wyoming uses burlap around the sides; the antelope can't see out, presumably they don't have as much of a problem. And again, that worked. The only failure that we really had was in Texas, and that was due to heat. We just let the animals get too hot, we lost almost an entire trailer load. It's one of the things mentioned in the manual; don't let them get above 70 degrees. It wasn't 70 degrees, but they were able to heat up pretty quickly. One of the things Bart was talking about is the net-gun capture. We've done quite a bit of that, especially with the capture of Sonoran pronghorn. In that case, you're looking for individual animals and that's when the net gun is a very, very valuable device. In these pictures, you'll see the helicopters sitting right on top of the pronghorn. The same problems that were discussed; it's very difficult to separate the antelope. They want to stay in a very tight ball. You don't want to get two at a time. You get two at a time and you have injured antelope. When you're working with an endangered species, you've got Fish and Wildlife service people all over you. You don't want to be breaking up any antelope. Some of the things that I didn't really see in the guidelines booklet are some of the things about releases or the release site. One of the things wildlife managers want to do is to release pronghorn antelope right here; it's got to be right here. If it's over there it's no good. And there's no way that I was able to get across to any of our people that antelope can run about 50

or 60 miles an hour. If we drop them out here they'll be over where you want them to be very shortly. So, let's release them out at this water. With some of our transport trailers, the animals cannot exit very well. Frequently you'll have to improve the site, sometimes literally dig a trench to run your transport vehicle in to allow the animals a satisfactory exit. Perhaps that's something you might see more of in a future addition of the guidelines where it says, open the doors and walk away. That is a very good method, but in many cases you'd like to prepare the area a little bit better so that when they do exit they don't jump out, dislocate a shoulder, something like that, which we've also had trouble with in the past. Another thing that I didn't see anything about in here is something that is very important to us; where can you release them. One of the things we've done a lot with bighorn sheep is to look at the habitat areas - habitat evaluations for releases. With pronghorn antelope, we haven't had that much problem with picking an area. What we've had a lot of problem with is getting landowner permission for a release. How many AUM's is an antelope worth or how many antelope comprise an AUM. That's one of the very first questions that a landowner hits you with. Now we can go to them and say well, it's anywhere from 105 to 7. That's not going to cut it. We're going to have to come up with something a little bit better; say, the forage overlap may only be nine percent but it could be 29 percent, we don't really know. I'd like to see a better answer on that. And that's really all I've got to say; I'd be glad to answer some questions when we're finished here.

I'm Bud Pyshora. I'm with California Fish and Game, and since 1961 I've been associated with our northeastern California pronghorn population in some fashion or another and been involved in a few captures. We've had some problems and we've had some successes, and with each one we seem to get a little better. Our last one worked very well. We basically use this system that's outlined in the guidelines, but like everybody else, I don't know of a biologist that's ever learned of somebody else's trapping system and didn't try to modify it a little bit. We do the same thing. The first capture I was involved in was 1977 when we had a herd of 100 animals in a 200 acre alfalfa field and they wouldn't leave. The rancher got a little upset, so in September we set up the trap behind a barn which was a good place to hide the trap. We then ran the antelope around the barn. It went really well and we caught 77 pronghorn. The problem we had was it was extremely hot and dusty and we lost some antelope to overheating in the truck before we slit the top. It got so dusty in the trap that we couldn't see the pronghorn and the pronghorn couldn't see you. There were a lot of collisions and everybody came out just black from this alfalfa field dust. That was the last time we trapped in the hot part of the year. In that case it was depredation trapping; we just moved them down to some antelope range we had in Lassen County that was deficient of pronghorn. That was a drought year and the pronghorn immediately left and went down to the alfalfa in another valley, and we established the herd there. We didn't intend to but it's doing pretty well. We had some problems with the weak trap fences in that some of our antelope jumped; so

we modified the trap. We borrowed Oregon's trap first, used it for a couple of trappings and then we made our own which is identical to Oregon's, which is identical to Idaho's, which is probably identical to most traps with the inriggers and the net so that when they hit the net they don't hit the uprights. Dimensions are about 45 feet by 90 feet. It works very well. We're not into the research and so we haven't a netgun and haven't used the drive net on pronghorns very much. We did use it to capture some injured animals after our last trapping. It worked very well. But, we don't normally do that. We use corral traps exclusively. One thing we've done if we have enough helicopter time is to put up the wing fences, get the helicopter, gather up the antelope, run'em through the wing fences and out the open end without the trap there and then as soon as they are through, we'll set up the trap. It seems to make them less apprehensive about going into the trap. We've done that on four occasions and it worked very well. This year, we trapped 270 animals. There were 1,300 animals in the vicinity and we didn't want to run all those through, so we did away with that and captured four groups without any problem. So we don't know how effective that is, but when we have done it, it seems that they went in a little earlier, a little easier. What I noticed this year was that after the first group was trapped, the subsequent groups are a little more nervous about going in the trap. I don't know why that is, maybe some sort of scent. We use the helicopter and line the beaters with burlap behind them, and the burlap is very effective. On trapping attempts we used a strip of plastic film. One time it worked; one

time it didn't. When we got into the helicopter the down draft started blowing the plastic around and the pronghorn could see through it. It didn't deter them like the burlap did. Once the pronghorn are in the trap, we hang burlap around and let them settle down. That works very effectively. We divide off the small part of the pen now with a draw curtain and try and run a few behind there and process them. What we have found is the bucks will get kind of aggressive in either the trailers or in the trap itself and they'll start ripping up the other animals. So when we get a group in there, we let them quiet down for a while and then we go in with a bunch of people and grab all the adult bucks that we can get. Then we'll start running small groups of antelope behind the curtains and then into the trailers. That works well. We use a little wider chute than they call for here. Last time we had about a 30-inch long chute. One time, we were going to some processing in the chute and so made a big covered chute. They like to be able to see out and so we line the bottom three or four feet so they can't see out directly. It seems to be a lot more effective in getting the animals into the trailer. We take the bucks, process them and put them in individual crates. If we don't have enough crates, we cut the horn tips off. The ones in the crates are given a shot of valium and antibiotic; I think vitamin E. They thrash around for about a minute or two and then everything gets quiet. We almost always use stock trailers and line them with burlap so that they're fairly dark; putting a lot of straw in the bottom. And once you get moving they bed down and travel very well. I analyzed the six trapping attempts I've

been involved with; about 700 pronghorn; and overall we had about a 3 percent loss. This last February we trapped 269 and lost 8; four on direct capture injuries and four in traveling. That might have been capture injuries that subsequently caused them to die. One thing we're starting to do at the release site is to put up temporary holding areas, line it with burlap, turn the animals into that and process whatever does are necessary and let them settle down. Just keep them in there for a short time and when they are settled down and get their group association, then we start to let them go. They go out in groups. It seems to work a little better that way.

We have six herds in northeastern California, and in each of those we have a population goal. When the goal is exceeded we consider either shooting more does or we relocate animals to suitable historic range if we have a place to put them. We've got a very receptive group of landowners around the state and in 1987 they wanted every one of the antelope so badly that at least three ranchers helped pay for the helicopter costs and some of our travel expenses; sent up the horse trailers. They don't have any desire to shoot the antelope; they just want to have them back where they used to be. The areas we're taking them to are areas that are devoid of sage. Looking at historic records; the San Joaquin valley and some of the coastal plains had probably the densest population of pronghorn in the United States. The railroad surveyor that I quoted in my report said that nowhere in the west could be seen more or larger herds of antelope than in

California in the San Joaquin Valley. And they had the big playas that are these huge, huge lakes that are caused by run off from the Sierras. As they recede there's tremendous weed patches out there. We have high hopes for the antelope that we're putting in historic range that had dense populations until the early 1900's. So far they seem to be doing pretty well. I'd be glad to answer any questions.

I'm Rich Guenzel, a wildlife biologist out of Casper with the Wyoming Game and Fish. Unlike some other states, we usually don't have much concern for transplanting antelope back into Wyoming, with a couple of exceptions. From the 60's up until the early 80's, we didn't do much other than supply antelope to other states. In the 70's they had to supply the trap as we didn't have one. About 1980, we got more interested in doing some antelope research pertaining to coal mining or other kinds of energy development, so the need for a trap that met our requirements came about and we started constructing some. There've been other designs besides the corral-type that have been used in Wyoming, although under limited circumstances. One of them would be the linear drive net. Another type of trap was the waterhole trap developed for catching animals in a particular area where you need to be a bit more selective. We had problems with mortality on drive trapping and wanted to be a bit more cognizant of the kinds of animals we picked up and made sure that they were in good shape. We were doing some heart rate telemetry and that sort of thing, so you want to have animals that aren't under a great deal

of harassment prior to being trapped. That was recorded in the workshop proceedings from 1982 that were held in Dickenson, North Dakota. I don't know if anybody has used that kind of trap much since then, but we had good results for our purposes. The net gun that others have talked about may to some degree supersede that although you don't have the animals run at all when you fire off the waterhole trap. The habituation of the antelope to the waterhole trap is an advantage. We've been doing a lot of movement and distribution studies in Wyoming, and that's where we largely use the corral trap to mark large numbers from different sites. Often times it helped to find herd unit boundaries in areas and it had use for other specific kinds of studies. We have a modified version of Colorado's trap that we've used the last two years. It is a bit more portable, a little bit smaller corral than many of the other traps, but it has cargo netting that's eight feet tall that goes on the wings and panels. It goes up rather quickly and comes down quickly so you can trap more than one site in a day. It's worked out pretty well. We have had some problems with trapping, but it has been with the way we conducted it. We try to trap in Mid-November to late December trying to get animals on the winter range and usually when it's fairly cool; good temperatures to work with, and the animals are bunched up fairly well. We had some wind problems; some storm problems this year and it postponed trapping one site. We came back and trapped about the 13th of January and had some major problems with hair loss. Part of that is due to getting too many animals in the trap. The later you go, the hair seems to get more brittle.

Consequently a number of animals were skinned up pretty bad. We know we lost some due to exposure because of the hair loss. If I was going to make a recommendation for the guidelines, I'd suggest that for those people trapping antelope in the northern end of the pronghorn range where winter is a bit more severe, that they should get it done by the end of December. Conductive heat loss, even if you don't have a lot of snow, can be fairly significant for these animals. That's a problem that you need to watch out for. We have done some transplanting in-state recently to remove animals that are in a problem area; like the Warren Air Force base which is the home of the MX. The Wind River Indian Reservation had enacted a game code and they wanted some antelope. So we trapped the Warren AFB and moved them to the Indian Reservation. A few years back some animals wandered into Rock Springs and we trapped those. We haven't done much otherwise in the way of transplanting because most of our antelope range is occupied. In the past, the density has been higher than most people wanted. There are some studies coming up and we may get into using either the linear net or the net gunning approach for those because we need more specific animals. By and large our trapping has either been to give animals to someone else to take away or for research purposes.

Tom Pojar (CO)

... reading over the guidelines that this conference published a few years back, I think if anyone were going to start trapping

that's an excellent place to start for determining how you're going to go about it. Anytime you start out with one of these techniques, there's so many different ways of doing it you pick up your own little ideas. If something works for you, you're going to keep using it. The method of choice used in Colorado is the corral trap with curtains that drop. I think it's pretty well described in the guidelines; the mechanism for dropping those curtains so you don't have to walk clear around the corral trap unrolling burlap. One person goes up, lets the animals in there, pulls one pin, and all the curtains come down at once so they're pretty much enclosed almost immediately. Then they circle inside the trap. We also use the half curtain and I think that's a fantastic idea both for the handlers and for those handled. Once you get the animals in behind that curtain there isn't a whole lot of room, so nobody can get a big run on anybody else,and when there are collisions they aren't very serious. I think that's quite a bit easier on the pronghorn.

Someone mentioned a drop net and how successful it was. He must have been in on one of the good ones. I'm glad Bart mentioned that we should talk about our failures as well as our successes. The drop-net system was an evolution from the drop net we use on big horn sheep where you bait them in underneath and set off the charges. Your drop net comes down, and for the handlers it's fine, because the animals are probably already tangled up and so all you do is just go down and restrain them. For bighorn sheep that works fine, but pronghorn are different critters. I think

they tried a drop-net in Wyoming, and as I recall the numbers, 17 animals were baited in under the drop-net when they dropped it. I think six of the animals survived. The rest tore up their muscles and they didn't survive. Our drop-net system is very similar to the corral trap only it has a roof on it. When you set off the charges everything just collapses inward and you have pretty much the same effect in that the animals get tangled almost immediately. All you have to do is go and restrain them. In theory that sounds really good, and for the most part it works fairly well, but there are some real tricks to it; some real hazards. The first and most important thing is not to get too many animals in there at one time. If you get more than 30 animals they can bunch up and you can really have a disaster. Even if you keep it at 30, you have to wait until the right instant to collapse that trap, otherwise you have 29 of them here and one of them over here. Bart mentioned to not get more than two animals under the net. If you could imagine 20 or so animals under a net together; you just may end up with dead pronghorns, or some that are really chewed up badly. So you have to wait until the right instant to drop the net, and if they are not spread out under the net you're going to get pronghorn tearing up one another in the net. We're not real high on that technique. The other bad thing is we use fairly thick nylon net, but they still come out almost naked. In cold weather it's not good for them. As I mentioned earlier, I think a good choice is pretty much what's described in the guidelines with the curtains. We feel that it is important to cut down the visual impact of people working around

the trap. It's amazing how they calm down once the curtains go down.

Bart mentioned drugs, and it hasn't been until recently that we had drugs that we could use where you could give a small enough dosage to allow use of a capture gun. Now we have one at least. We haven't tried this, but I'm fairly certain it will work if we want to be selective about collecting animals. We have an area in northwest Colorado where water sources are fairly isolated. The pronghorn have to come to these water sources and I think we could capture them over these water sources. Archery hunters have a success rate of 58 percent out there. The success rate was so high that we had to put limited licenses out there because they can really make an impact on the population. They'll set up a blind a short distance from the water source and after a few days the pronghorn get used to it. They will come right down and I think even I could probably hit a pronghorn at that distance. I think that would be fairly effective.

Mentioning drugs, there's another drug on the market that we've tried on some of the tame animals in our facilities at Fort Collins. It's a good drug that puts animals down quickly and there's no reversal needed. It puts them down for about a half hour to forty-five minutes; takes about one to one-and-a-half cc's to put a good sized animal down. The nice part about it is it's quite a bit less expensive than the drug Bart was talking about. That's about $10 a throw for putting an animal down this way.

It's available through a wildlife laboratory company in Fort Collins. If anyone wants to try it, get hold of me and I can put you in touch with them. Again, we just tried it on tame animals so we don't know if we'd run into some of the same problems encountered when shooting animals in the wild. Maybe some of you have seen the publication that I was a co-author on, where we used valium to calm animals down and capture some semi-tame pronghorn that were coming in to feed in the enclosure on the Pawnee grasslands. We had four animals we wanted to get and were very careful to calculate the correct dosage of valium to put in their food so that we could get them groggy and then capture them. We mashed up the valium pills, and put it in their grain and laced it with syrup so it would stick to the grain. This went well but we overlooked one factor and that was the idea of dominance, even in a group of four animals. We had a dominant little yearling buck that got more than his share, and he was really drunk for about three days. He just staggered around, but did come out of it okay. If you just wanted to slow them down a bit so they'd be easier to handle, I think Valium would probably be okay, but at that time it was expensive. The price has come down quite a bit since then. Another drug that we tried, R51163 works well on caribou so we thought it might work on pronghorn. You inject caribou with whatever dosage was needed, and they would become docile. They wouldn't go down, but would just walk around, and you could walk up and take a regular blood sample; they just became real manageable. Nothing bothered them. We decided to try it on the pronghorns, so we figured out the dosage, weightwise,

that we used on caribou. Pronghorn biochemistry is so different from other animals that you never know what's going to happen. We injected one of our tame animals with the same dosage we put into the caribou. I don't know what was going on in his mind, but his motor activity increased, his feet started moving and we let him out. He kept moving and ran for about 45 minutes, around and around. We thought, well they are different biochemically so we probably should double the dose. We gave him exactly double what we gave him before. It had an effect. He went faster and farther. So we thought, we'll just try and take this to the limit and we came back in and doubled that dose. He went faster and farther. We figured that wasn't a very good drug for pronghorns. We don't do a great deal of trapping anymore. We may trade with other states for animals like otter, turkey and bighorn sheep or something like that.

I'm Don Wilt from Pendleton, where I work for the Oregon Department of Fish and Wildlife. Those of you people who know Oregon very well know that Pendleton is not the capital of antelope at all, so what am I doing up here talking about antelope? When I came onto the district in 1977 I got a briefing of what was in my district and right at the very tail end somebody said, "Oh, by the way, you've got a handful of antelope down on the Umatilla Army Depot and we don't know what the hell to do with them." In 1969 we had a corral trap operation just east of Bend at Brothers and captured some free-ranging pronghorns. Seventeen antelope were released onto about 200,000 acres of what we felt at

the time was prime antelope habitat on the Umatilla Ordnance Depot. We put them into a small fenced pasture because of the numbers and the desire to overwhelm predation losses. In the meantime, somebody invented the pivotal irrigation system, and our desert country there turned into potatoes, alfalfa, and what have you. By the time our population began to pump out numbers, the habitat was basically gone. We could have gone ahead with our original plan but those antelope would have been in trouble five minutes after we turned them loose. Their numbers were down substantially. I was appreciative of the comment about the magic number of 100 antelope, in that we really struggled with that small number of antelope. We went to the point of bringing in ADC for predator control. As a matter of fact, we did it too well. We actually had some people on the Army Depot that were really interested in seeing that herd grow. They spent a lot of time going around their 8-foot cyclone fence plugging all of the holes that the predators could use to come underneath the fence, and by the time we resolved that and then trapped pretty heavy for a couple of years inside the Army Depot, we had reduced predation to the point where the antelope population really took off. By 1983 we were at about 250 head of antelope and some concerns about carrying capacity, crowding and disease began to emerge. A real problem is that the Umatilla Army Depot is one of three installations that store and maintain biological agents like nerve gas. The opportunity to have any kind of hunting as a means to maintain that population at a desired level is nonexistent. So we began to look for some forms of trapping and translocation to

handle that population. In 1983 our trapping effort was a total failure. I thought what I'd do here is to show you some of the things that we ran into with this captive herd that would not necessarily be present in a free-ranging group of antelope. The only good thing out of our 1983 effort was the joke that it was the antelope 100 and ODFW 0, but we did manage to break the regional supervisor's wrist and the memos out of his office slowed down for awhile. We were ultimately successful there. What we did in 1983 was to use a helicopter and the drive-trap system. The problem was that the antelope were very fence wary as they had grown up with those fences in place. The Army Depot is also as flat as this table top and you could not find a place to get enough relief to hide that trap well enough to get a head of steam on those antelope and get them to go through the wings and into the trap. They would simply pull to right or left and roll the wings over. You were just simply not going to get those animals into it. So, in your publications, the placement of those wings and the hiding of that net through the use of relief should be emphasized, as I feel they are very important.

Within the 225,000-acre enclosure, there is a 250-acre enclosure identical to the fencing that we found on the perimeter fence. So, we began playing with the idea of trying to use water manipulation and salting to bring those animals into the pen of their own free will during the January period. We were very successful in doing that. Our first attempt in 1985 then was to bring the animals into the 250 acre enclosure. Then we drove them

into a modification of the corral trap. This just took too much hair off the animals. We gave Nevada some skinned up antelope and were not very proud of that. We then took the information we had learned from our original attempt; that those animals could be driven along the in-place perimeter fences. We would simply bring the animals into that larger pen of 250 acres, use pickups to put them up against that fence and then drive them along the fence with the necking-down wing on the outside. They were then driven into a 90' by 50' self-supporting cargo net fence that you see described here, at which time we would then put them down with lot's of manpower. The reason that we're electing to do this is that we can put 60 animals into that net and have enough people to have two people per antelope. You can count to about 10 and you have about all the antelope on the ground. Now we have direction that we will take blood from up to 10 percent of all animals we translocate. One of my recommendations that is not mentioned here, is that a blindfold be incorporated into this situation, especially if you're taking blood. We incorporated the blindfold, and it really calmed them down, and I think it reduced the stress level substantially. We had not used those cross-drops inside the trap that you're talking about, but I think after listening to you people we would probably try that to see if we can slow the antelope down and get them settled down faster. I doubt we will ever be able to hunt these animals.We do have some good antelope habitat in areas that have BLM, some Forest Service and a lot of private lands intermixed. We look at it and say that looks like good antelope country to us, but we haven't been able to address

the problem of putting antelope into a private land situation. In the Powder River country, which is in Union and Baker counties, we have gone to private landowners inside that land mix and obtained agreements allowing antelope transplants with the understanding of hunting in the future. It worked very well, and we're hopeful we can try this elsewhere. We do have habitat for pronghorns that is vacant.

O'Gara: Somebody had asked me about water for cooling down pronghorns when you're transporting them. We have just hosed pronghorns down in traps and trailers. It helps some, but you have to get them from the rear, otherwise it's like pouring water on a duck's back. They have oily hair, and it just beads up and runs off, something like a well-waxed car. But if you can hit them from the back side and turn their hair up you can wet them down pretty well. It does seem to cool them off pretty fast. Dan Eastmen had asked about whether anything more should be done with the trapping and translocation guidelines. If I was doing it I would add something on drugging, something on net guns and maybe something on criteria - a checklist for suitability of habitat to transplant into. I'll just leave you with those thoughts. (Any questions and/or additional comments were lost from the tape.)

Panel Discussion: Given No Funding Limits, What Would You do for Antelope Habitat.

Jim Yoakum (NV); Don Beale (UT); Frank Hall (CA); George Keister (OR).

Yoakum: The panel is supposed to talk about antelope habitat, and if you had all the money, what would you do to make the best of antelope habitat. Question is, and it seems like this afternoon's session out there between the rain showers, sure brought out - it was apparent there are quite a few questions relative to good habitat. What is good habitat? Or as a manager, what are we striving for, what is desirable out there? What kind of vegetation? How much? What species? What composition? What about water? Do we need water for antelope? Do they really need water? Some publications say they don't need water. If we do need water, how much of it do we need? Do we need it every half-mile, every mile? Do we need it 12 months out of the year or only certain months of the year? These seem to be pretty good questions and they seem to be some of the questions that are in the minds of various ones of you.

Keister: In Oregon, Harney County is what I'm most familiar with. It is a little over 10,000 square miles and that's about 6,400,000 acres, and half of it is BLM. So we've got a little over three million acres of habitat that's controlled by BLM, and out of that they say they have about 2 million acres of big sage. This is Wyoming big sage, about half of which is in dense stands. Dense stands of big sage are not used much by antelope. They might pass through

it but they just don't use it. So, to me, I really think in Oregon we have potential for increasing, or improving habitat for antelope. I think that potential is greater for antelope than for any other animal in Oregon. To me, the obvious thing to do is to open up some of that habitat. Antelope prefer lower vegetation and so, what I propose is to open up the habitat and make pathways from the areas that are now being used to other use areas. What we've been trying to do in the past is increase the density of the antelope on an area. This proposal would not increase the density necessarily, but would increase the number of acres available to them. There are a couple of different ways to do it. One would be mechanically and then seed it. Talking with BLM biologist Fred Taylor in Burns last week, we ran through some ideas and we're looking at about $50 an acre to do that. I know that we've got all the money in the world here, but the other way would be to do some controlled burns and probably to get it to the degree you want, the patchiness that you want, you'd have to do a lot of mechanical work, and we figure that would cost about $10 an acre. These are rough numbers, but the idea would be to decrease the sage brush cover from about 20 percent to about 6 percent, and you might want to fly on some seed. There are certain things like yellow blossom sweet clover, that's 37 cents a pound. Some alfalfa maybe, some other forage species and you might be able to enhance a controlled burn. The other thing is to prevent or discourage livestock use for the first two years after the burn. A possible way to do that would be to fence off whatever water's available; fence it off so the cattle won't want to get too far

from water but the antelope can go further. The antelope can also go under the fence to get the water.The program is, I believe a practical possibility. If you look at the million acres that I said we want to work on, and you wanted to do 20 percent of it; you wanted to do it over a 20-year period; that would be about 10,000 acres a year. At $10 an acre, that's $100,000 a year. That's something that could be done.

Q: When you mentioned fencing off water sources, how big a fence would you be talking about around that water source?

A:Keister I would say just a regular cattle fence; make sure that it's not so low that the antelope couldn't use it. Include all the riparian areas, and I would propose to keep that fence for the benefit of wildlife.

Q: How many feet of fence are we talking about. Are you talking just right at the edge of the waterhole?

Yes, just to prevent the cattle from getting to it for the first two years. Then you might take it off the waterholes and go with some of the standards that have been established in a number of publications. If lack of water's a problem, I would say put it in at the minimum level to benefit antelope, therefore, discourage cattle and not increase livestock AUM's.

Q: Would antelope utilize that water source if that fenced area was too small? With a wary animal like that, I wonder how big that fence would have to be.

Comment: I'm thinking of some water catchments in Arizona where just a minimum of fence was used . Pronghorns wouldn't move into them. Also, in the Red Desert in Wyoming where they had guzzlers specifically put in for antelope. When they fenced them in close, the antelope wouldn't use it. The moment they took the wires down, the antelope moved in and used them. I know in parts of Utah that question came up and our conclusion was that you could fence a large area, at least an acre or two. That's pronghorn, specifically, deer are not so much of a problem, nor are big horn sheep. But for antelope, it seems like if it's too tight, they're just not going to use such water developments.

Q: Jim, don't you think if you had existing water holes that had been used, that you could fence them a lot tighter? It sounds to me like putting in new ones and fencing them tight, the pronghorns wouldn't start using them.

A:Yoakum Yes, I would think so. Don, what has been your experience?

A:Beale What you've said I find very true. With antelope that are not used to crawling under fences, you're going to have problems when you fence a water source. With a much larger area your chances are much better. Once the antelope have established going to that

waterhole at some occasion, you allow them to negotiate these fences by leaving a gap underneath.

Comment: The last few years in Oregon there have been a lot of wild fires, and I think they have created more habitat. It's not necessarily the structure that you want. Some of these fires are pretty hot and just burn everything.

Q: Cattle grazing is part of the scene right now. Would you buy off the cattle grazing and say okay that's it, no more cattle on here, this is being managed for pronghorn?

A:Keister I don't know. I just think if we don't increase the AUM's and we minimize the water structures, it does benefit the antelope. I think it takes a lot more water to attract cattle than it does antelope. I think we could discourage cattle use on this new habitat. What does everybody else think?

Q: Would removing cattle be totally of benefit to the pronghorn? If it's not advantageous to totally remove them, how would you use cattle to enhance pronghorn habitat?

A: Everybody has opinions and that's all that I have on it. I don't think that cattle grazing is detrimental around the water areas and the riparian areas, because they hang out there. But there's a lot of the uplands in the area that I work in, that the cattle never ever go to. So I don't think it's that big a detriment if we can protect the water area.

Comment: As long as we've got lots of money in this theoretical program, let's try a couple hundred square miles, take the cattle off, shoot for forage diversity, maximum output of as many grass & forb species as we could. Let's try it because we've never done it anywhere. That might be something that would be nice to see.

Comment: The other side of that coin might be to go in and fence off a couple hundred square miles and just cattle it to death until the cattle were losing weight and then turn the pronghorn in there and see if they still make a living on it.

D.Beale On some ranges, during certain seasons, there is quite a bit of diet overlap between cattle and antelope. We thought of using the cattle in place of the bison, which apparently went together quite well, historically. I think it depends a lot on the area you're talking about. In Utah where we've shifted from sheep to cattle; this is on a winter grazing situation; our animal ranges improved immensely simply because the cattle have eaten the grasses. The sage brush, the black sage, the lower sage brush species have come back, to some degree; antelope habitat has improved, and antelope numbers have improved. At the same time where we've had cattle brought in, and a summer situation, particularly spring and the early part of the summer, it's been the reverse. Now this is on relatively dry ranges in the six, seven, and eight-inch rainfall belts. And there the competition, the cattle being there in May and June, are heavy users of the forbs, just like the antelope.

I think that the overall problem becomes a lot greater on the more ephemeral ranges of the Great Basin, than on the Great Plains ranges. The other thing you might want to throw in is almost uncontrollable feral horse use of some of these ranges. We've got essentially five ungulates on some ranges in a very low precipitation area and there's just not that much room. It's pretty tough up there - a lot of competition.

Kaschke: We had kind of an interesting one down in Sheldon, at the refuge there, when we established our plan. We had what we call antelope reserve areas which supposedly weren't to have any grazing on them, but they had been grazed because they were not fenced. In 1978 and 1979 we went into a grazing system with livestock treatment and allocating forage for various game animals including deer and antelope. One of these areas was Gooch Table, that's an area of probably 60,000 acres. We pulled the livestock off, gathered all the horses, and in three years time we noticed a remarkable decrease in the number of antelope that used the area. We went in the following year and put the cattle back in there. The following year our antelope came back in and used much as they had in the past. We don't have the numbers to say what degree of change we were dealing with, so we don't have very good information on that but I have a pretty good gut feeling that if you pull the cattle off the range, in three year's time you're going to decrease the antelope use by quite a bit; maybe as much as half. The antelope are going to move over to where the cattle have been using. There's a lot that I don't have a real good feel

for, and I've got a lot of questions about that. Just how do you use cattle and when.

Yoakum: We're talking about a subject that came up before, and it's clear that pronghorns today, at least, are on range lands that are used in common with domestic livestock for 98 or 99 percent of the time. And the antelope population is going up at the present time.

Q. I was trying to think of what would be the ideal form of habitat and I think the place to start would be where we have the highest densities in the country.

A. I'll tell you; it would be Campbell County, Wyoming.

I flew places in Campbell County where we had, on private property, one antelope per ten acres; 64 per square mile.

Hall: The densest population in Lassen County, California is in an area that is checker board alfalfa and intervening low sage primarily. It has had about 300 antelope per square mile of summer range. This is an area of about six square miles. It's a summer population. They heavily utilize the alfalfa that grows on one square mile blocks.

Yoakum: There is a problem with drawing a circle around where the most antelope are in the country and saying this is ideal habitat and

make everything apply to it. You're stuck with what you've got, that's the first problem. Here we have sage brush. We're not to make it like eastern Wyoming. But we can open up the big sage brush that they're not using and make it better. The other problem with that sort of analysis is that there are other reasons for high antelope density besides just habitat. In this part of the country I am 100 percent convinced we have great habitat for coyotes. And I don't know about other places like eastern Montana and eastern Wyoming. I'd like to know more about it, but that's another reason why in some places you have greater antelope densities. I know that up here in Oregon there's some places where they had quite high fawn ratios every year and one of the reasons is, it is privately owned and they don't all raise a lot of coyotes. So there's habitat reasons and there's other reasons. The other thing is we've got to live with the habitat we have and make the best of it. We've got different habitat here in southeast Oregon.

Comment: I was struck by your earlier comment about the alfalfa checkerboaard area. I certainly am not an expert, but it's been my impression based on what I've seen, that usually there's a certain amount of agricultural land blended in or even found as a mosaic with the rangeland; you have an 80 of alfalfa here and 120 of spring wheat there. Sometimes maybe antelope don't necessarily have to or maybe even do their best with just pure rangeland. Some of the agricultural crops can actually benefit them.

Yoakum: In those situations you're just providing a cafeteria feeding area, somewhat apart from a wild native range that you're talking about managing. You're talking about having a lot of money in this discussion; what do you do with your money. Nobody has all the money they know what to do with, but a number of states are still looking at new sites; transplanting animals from here to there, trying to establish new populations and in so doing increase the number of animals that can be hunted, etc. Maybe we can take just a minute and discuss some of the things you might be looking for in an introduction site. What we want in terms of fawning habitat. We probably want a large broad rolling area, not dissected by a lot of deep ravines which can provide habitat for predators such as coyotes or bobcats. In the dryer belts, we certainly want good water distribution. The distance you want this water spaced depends a great deal on what your rainfall is; how dry you actually are. If we're down in the six inch rainfall belt then I think we need to be looking at water spaced every couple miles. We found on the desert range that that's about the distance; about a mile is the maximum distance a doe with fawns will move to and from water. If we had water spaced at greater distances than that then they tend to move towards the water and you find vacancies of unused habitat. We want a habitat that has as large a forb component as possible. And we want to manage the livestock that we're using on that plot of land in such a way that we would have the summer forbs available.

What about the winter ranges? In this country as much as 80 percent of the winter diet is sagebrush. What are antelope eating in other areas that don't have a lot of sagebrush.

It goes back to talking about that mosaic we mentioned earlier.

If you had a lot of money to spend, what ways would you interface with private landowners and agricultural developers.

Hall: Some of you are familiar with the private lands management program we have in California. We actually have landowners coming to us, and we're getting into habitat management agreements in return for which they can get access to tags. Maybe I can go through some of the habitat improvement work that we're trying to get these people to accomplish. We use mostly dry land alfalfa, in blocks. There's a place called Grasshopper Valley, about 11,000 acres, where we put in 20-acre blocks of dry-land alfalfa per secton. It provides added diversity that didn't exist originally. Antelope use it extensively and it does receive moderate livestock use. Each of those plots is fenced to exclude livestock from the alfalfa. One habitat component you didn't mention that I think we tend to ignore on a lot of western rangelands is fences. I think that those are significant in the role that they play in regards to predation. We're doing a lot of fence modification, lifting up bottom wires over X miles per year; doing a lot of conversion of fences in some places. I don't have any data or analytical literature to support some of this, but I have a strong feeling

that poor fence design and construction is costing us a lot of pronghorn every year. So we're putting a lot of emphasis on those kinds of things. We aerial gun coyotes every ten days immediately prior to kidding. Some of the landowners do this at their own expense. There are several other things that come to mind, but those are the kind of things that I'm working with on the private lands situations. Again these are better sites than we have a lot of times on the public lands. They are often well watered lowland, better soil types, and better growing conditions. We don't have a lot of antelope in those situations on the public lands of course. Good sites were long ago snapped up by priviate owners.

Q. What kind of longevity do you get on dry-land alfalfa habitats?

A.Hall: Well, we haven't been in this for more than about three years so I can't tell you. We have some that have failed and been replanted. I've got to be honest about the success of those. Mostly we've had some terrible years for growing dry-land.

Q: What type of dry land alfalfa is down in that part of the country? We tend to go 10 to 15 years.

A.Hall: They'll probably get 10 to 15 years too, on dry Nomad.

Yoakum: What would you guys like to see for range conditions. What I'm talking about here is I've been involved in different places where

we really don't want to manage for good or excellent ecological site conditions. How do you feel about that?

Keister: I think that forbs are more important than grass. Of all the dietary studies that I'm aware of, forbs are a large component after grass, for most of the year.

Yoakum: In terms of forb sites, we need to be thinking in numbers of perennial forb, not annuals. The Russian thistle in its early-growth stages; that's about as powerful as any other forb going. But it's something that's here when we get rain. If we get a year or a season we don't have the rain, it's gone. If we can talk in terms of perennial forbs, it's somewhat affected by drought, but it's far more stable than many of the annual forbs. And so if we're talking about perennial forbs, then we're not talking about a highly depleted, highly over used, highly over grazed range particularly. Many plant communities in good range condition will contain a fair amount, if not a considerable amount, of good perennial forbs. That's the component that's going to be very significant in making a high quality antelope range.

Q. George, are you suggesting taking a high sage stand and converting it to something else?

A.Keister: I was just suggesting burning it. Control burn is best so that you get islands of big sage. You'd have to do some reconnaissance and make sure you won't be promoting a rabbitbrush invasion after a burn. Try to get it to come back to some grass and mostly forbs; encourage forbs. With lower structures you will encourage antelope to go in there and eat those forbs. Before, that wall of sagebrush was keeping them out, except for an occasional antelope that passes through. Up in Bear Valley, which is one of our study areas around Seneca, a lot of country has been converted, and we had three classifications of conversion. We had new, medium aged and old seedings. That's the way we looked at'em and some of those we followed about 20 years.

Some of'em are pretty old and those were some pretty good ones as I remember, because you'd start getting some of the native species in there. A lot of them were crested wheat; some of them have some intermediate wheat grass and usually some alfalfa. You also had some of the native species and native forbs in there and some sage brush coming back.

I think it would take a lot of thought before you actually went out on the ground and did this work. If you have a big area like this study area Mitch was talking about, Jackass Creek, most of the antelope use is in low sage brush. And then on the fringe of

it you get into some big sage and there you have some islands of big sage which they use. Well, give'em a pathway in between; open up some country. You would probably take an aerial photo, look at it and see how you want to lay it out. Go out on the ground and take a look at it and see what kind of species are growing there and try to predict what you're going to get from your burn. Also coordinate with your sage grouse needs.

Comment: The situation you described is Wyoming big sage. Would you treat a township at a time? Would you treat ten sections at a time? Would you treat 8 sections at a time? You are dealing with large monotypic vegetation areas.

A.Keister: I proposed treating 20 percent of the area and that's no magic thing at all. I would be real sensitive about wiping out too much big sage. I know that most of the antelope winter in areas where they eat a lot of sage brush, and I don't want to lower the carrying capacity out there by treating 80 percent of the big sage. I think 20 percent of it's safe though. We're going to open up some habitat and still have plenty saved for food. I'd be real interested to hear from some of the other people that are biologists around this country too, because that's just my opinion. They might think; yeah that's pretty good, but you haven't thought about this or that; we can't do it because of some other reason. I'd like to hear some of those opinions.

Yoakum: I don't know how much time we're going to have right now, but then the last vehicle I was in I heard about six of those biologists say that you would speak for them.

Keister: Now I don't believe that.

Yoakum: As a possibility of wrapping this up a little bit, I've heard people mention several sets of guidelines and some other pieces of information that could be helpful. How many of these guidelines and these batches of information are helping you, providing the information you want? Do you need more? Are they adequate? I know of five different sets of guidelines for managing habitat that are relative to pronghorn antelope. And the question I'll pose to the group here is; how many find these sets of guidelines of help to you and your work? The first one is the Pronghorn-Antelope Workshop Guidelines. (Unknown numbers of attendees indicated awareness of and use of the guidelines.)

The second set of guidelines is the Interstate Antelope Conference. I realize this is a more limited area but the Interstate Antelope Conference has a set of guidelines. How many of you work with these and find them of help in your work?

Seven?

Next. BLM notes on managing pronghorn-antelope habitat. Okay, raise your hands.

(Unknown number of participants indicated use.)

Next one is the Wildlife Society Techniques Manual. Okay, raise your hands. Some of you guys can really read, huh? Seven? Okay, last is Wildlife Habitats on Managed Rangelands. Okay.

One other, Wildlife Habitat Relationships? That's a California publication that is an offspring of Wildlife Habitats on Managed Rangelands.

I have a couple of comments. At the last meeting of this group, the Wildlife Habitats in Managed Rangelands of the Great Basin had just come out and we mentioned that we were getting some extra copies. I was able to bring a few boxes of this particular item to this meeting, so for those of you that were at this meeting two years ago and I promised copies - I have them. See me sometime in the next couple days and I'll give you your copies. Keep in mind that the guidelines cover not only pronghorn, but deer and other species such as sage grouse. Keep in mind that many of you have already obtained your copies by now. But the publication will probably not be reprinted, and so if you do want to get your copies, now is probably the time to get them. Another comment that I would make is that BLM has just put out a new self-training module which is a course that has 140 slides and a tape for self-training. It has a course outline and exam, and it can give you ideas of what kind of fences to build, what kind of water distribution you make for the benefit of antelope and the like.

If you're interested in this particular item either contact myself or the state offices of BLM. Use it as a training item for habitat management for pronghorn antelope. I believe we've taken our time.

Q: I'd like to ask one more question. Maybe Jon Sadowski could address this, or maybe some other people in the group have an idea of the effects of the Vale project on antelope populations.

A.Sadowski: The biggest part of the Vale project took place in the resource area that I've been working. There were some real problems with over-obligation of forage on public land in the Vale BLM district of southeast Oregon, and there was a lot of congressional inquiry into this issue. The upshot of it was that the Bureau spent a lot of money converting sage brush to wheatgrass and on water development, fencing, and a whole series of things in order to stabilize the livestock industry. My personal observation is it just depends on where you are within the district as to what the effect was. I don't think there's any question that some of those huge seedings had a heck of an impact as far as eliminating a lot of sage brush. There are some increases in antelope in there from what I understand.

Pronghorn Habitat Preferences in S.E. Oregon

Keister: I'm going to talk about antelope in Oregon again. Back in 1981 and 1982 we started a study of fawn mortality and habitat use of

pronghorn because of a long-term decline in the fawn/doe ratio. In many areas we recorded fewer than 25 fawns per hundred does. I worked on this study with Mitch Willis, Chuck Trainer, and Dennis Sheehy who did most of the habitat work. What we wanted to do was to take two areas; an area of high productivity and one of low productivity and try to understand why they were different. The area of low productivity was the Jack Creek area which is about 40 miles south of Burns. In that area the average fawn/doe ratio for ten years before the study was about 21 fawns per hundred does. The vegetation there is similar to what we were in today with a lot of low sage brush as well as big sage brush; Wyoming big sage. The most common grass is Sandberg's blue grass. There's also some Idaho fescue and blue-bunch wheatgrass. The other study area, Bear Valley, for ten years before this study had an average of 74 fawns per hundred does, which is real good for Oregon. It's an area 50 miles north of Burns which would make it about a hundred miles north of this Jackass Creek study area. It's a lot different area to look at; it's surrounded by forested mountains and it's about an 80 square mile study area. The Jackass Creek study area is 120 square miles plus. Bear Valley also received more available moisture during the year. The rainfall isn't that much more, but the valley is surrounded by mountains which go up as high as 9,000 feet, it has cooler temperatures, has a snow pack, and you've got perennial streams going through the valley. The Jackass creek area is at about 5,000 feet elevation and that's about it. Once the snow melts in the spring and it dries up that's all, except for some thundershowers during the summer.

There's some waterholes there, but there's no perennial stream flow. Another big difference in Bear Valley and Jackass Creek is the fact that Bear Valley is solely privately owned. The difference that made and what we found out was that the abundance of coyotes was much less, particularly during that first month and a half of life for fawns. During the study, which was '81 and '82, There was a real peak for coyote abundance out here on the sagebrush steppe lands of Harney County. Those fawns were under tremendous pressure during that period of the study, '81 and '82, when we had nine and two fawns per hundred does, respectively. In Bear Valley we had 45 and 85 fawns per hundred does during the same period. The main thing was that the ranchers just didn't tolerate a high level of coyotes up there, whereas down here we had one or two trappers working over a real broad area. Habitat wise, what we did was compare the proportion of use of habitats to the availability of those habitats or vegetation types, and thereby came up with preference indices. To do that, we wanted to know what was available. We used aerial photography to delineate vegetation types and then ground truthing. To determine use we had radio collared fawns and periodically obtained visual locations on'em and measured those sites. We also had survey routes where we determined use for all other categories of antelope as well; bucks, does and fawns. On the fawn-use sites we had a 400 square meter macro-plot on which we measured cover of grasses, forbs, shrubs, and the height of shrubs. The first year we also looked at visibility. We had a graduated stake and we measured how much we could see from a certain distance. After

about a year of that we weren't really satisfied with the way the data was describing how those animals used the habitat. It just didn't feel right, so one day sitting out in the middle of a stand of big sage we were trying to think how we could look at this visibility differently. We came up with this idea of shrub volume, which is the amount of shrub volume within a certain area. We started calculating some of that which was basically the heights of the shrubs times the cover in this 400 square meter plot. The more we looked at it the better we liked it, and at this time we really think it's the best quantitative way to describe how antelope view the structural component of the habitat. We found out that we weren't the first ones to discover this. As far as I know, Pyrah in Montana was the first one to use this approach. Several other people have also calculated shrub volume.

Trying to contrast the two study areas, you'll find that the stand size of the different vegetation types was quite a bit greater out on the shrub steppe than what we had in Bear Valley which is the inland valley. About 20 percent of the area in Bear Valley had been converted to stands of crested wheat or some other grass, and usually had some alfalfa in it. The average size of those stands in Bear Valley was about 100 acres. Then you have a wide variety of different types of low sage and meadows which occurred in Bear Valley but not at Jackass Creek and of course there were some that occurred at Jackass Creek but not Bear Valley. We had some juniper at Jackass Creek and some forest at Bear Valley. In

addition, at Bear Valley, there's a lot more plant diversity. We had 217 different species that we classified there versus 99 at Jackass Creek. Also, we had 15 vegetation types at Bear Valley which included agricultural types and five at Jackass Creek.

I'll talk about the habitat preference for a minute and this is Jackass Creek here. Again, the way we calculated this is to divide the proportion of use by the portion of the vegetation type available. I lumped the vegetation types into vegetation categories so we could compare the two areas. This is from survey routes and you can see that all categories of antelope preferred the low-sage types, particularly the low sage brush/Idaho fescue type. The big sage was not preferred or was avoided by all of them. Silver sage is kind of interesting. We found that the bucks had a 1.9 rating. Now a 1.0 means its neutral. A zero means that they don't use it and anything above one indicates it is preferred. So 1.9 is pretty good and the bucks were using that during the study, but the does and fawns weren't. The years 1981 and '82 were wet years, and they were also extremely low antelope productivity years. As I told you, we had nine fawns per hundred does in '81 and two in '82 so most of the fawns were dead after a short time. Later on when we had finished this study we were still working on coyotes and sage grouse. We saw that the does and fawns during the drier years were also using the silver sage brush, but we didn't take any data on it. During those years of the study, we did see this differential use of the silver sage brush. The juniper was not used. Mosaics of big sage and low

sage were used later in the summer when it started getting dry. Quite often you'd find antelope bedded down during the middle of the day in the middle of some big sage, probably in the shade, plus there's probably a little bit more moisture content there later on. In Bear Valley we again see a preference for the low sagebrush types. Big sage is avoided again. Now the big sagebrush of Bear Valley is different. Bear Valley has the mountain big sage. Again, we get this differential use in the silver sage dry meadows. They don't have the playas there, but they have these dry meadows and some of'em had silver sage, a different kind of silver sage. But, the bucks used it and the fawns and does weren't observed in it. The dry meadows were used by all groups. The wet meadows showed very low preference. But again this is something that changed. Later in the year as the wet meadows dried up and they were hayed about the first of August, then antelope started using them. I guess one of the bottom lines is we believe that habitat structure was the main factor that determined the use of habitats in these two areas. Of course, in Bear Valley they had a lot more choices about what habitats they wanted to use, but the main thing was the structure. We found that they used areas with low shrub volume.The agricultural area had 33 percent of the use. Preference was about neutral, but it had low shrub volume - 4.3 cubic meters. The dry meadows had very low shrub volume, and they were used heavily. The low sagebrush had 27 percent of the use, and it had a shrub volume of 20 cubic meters. Big sage brush on the other hand, although it doesn't show a high preference, had 19 percent of the use. It had a shrub volume of 24.8.

At Jackass Creek, antelope used low shrub volume. The low sage here was 17 cubic meters and had 67 percent of the use. Big sage had four percent of the use, and the shrub volume was 59.8. The big sage in Bear Valley was 24 cubic meters and 60 at Jackass Creek. We think the difference in that shrub volume was the reason why 19 percent of the use was in big sage in Bear Valley and only 4 percent at Jackass Creek. I'm going to try to give you an idea of what I'm talking about here, because I know these numbers don't mean anything. Low sagebrush, the kind we've been seeing out here might have a cover of 17 to 20 percent. The height might be 10 inches. That gives a shrub volume of 17 cubic meters. The big sagebrush on our study area has an average height of 31 inches. Thirty-one inches and about 20 percent cover, so you get a shrub volume of 60 on up to 80. We also measured a random sample bunch of representative sites and found the average of big sagebrush was 80. Sites where we saw fawn use of big sage, the average was about 60. So even with them, they selected for lower shrub volume big sage areas. Between years and between study areas, we found that each year there was a difference in preference for vegetation type. But there was a consistent use of shrub volume the whole period. On the study areas, 75 percent of the use was in areas with 23 cubic meters or less. Ninety percent of the use was in areas with less than 31 cubic meters. So, you can have low shrub volume two different ways. You can have low sagebrush that's got high cover about 10 inches, or you can have sparse big sagebrush like the mosaics. If they can use that they go all through it. But, when that stuff is dense, they seldom use

it. The silver sage is another thing. It can be pretty dense but it's low and we find'em using that. That's why the bucks showed a preference for it. So, I guess I come now to management implications. First of all, we think that conversions can be beneficial for antelope because it lowers the shrub volume. If the size of structure of the whole thing is taken into account, we would caution against too much conversion because we think ultimately you'll lose diversity and also you could lose some winter carrying capacity. I mentioned yesterday a 1952 study done here on Hart Mountain by Ellis Mason. He collected antelope over a period of time and found that between September and March, 83 percent of the diet was sagebrush. In this country you want to be careful about converting too much. At this time I don't think there's any danger of that. I think shrub volume measurement is a good technique for evaluating the habitat potential for antelope and also the potential for conversion for antelope.

BUSINESS MEETING

Minutes of Business Meeting

13 Pronghorn Antelope Workshop
Hart Mountain, Oregon
June 7, 1989

The business meeting was called to order at 4 p.m. Delegates were present from Alberta, Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, Oregon, Utah and Wyoming.

No delegates attended from Kansas, Mexico, New Mexico, North Dakota, Saskatchewan, South Dakota, Texas and Washington.

Old Business

I. Depredation Guidelines

This topic was discussed during the business session of the 12th Workshop held in Reno in 1986. No progress was made at that session or this one; however, Oregon agreed to provide a province/ state representative mailing list to Arizona (Ray Lee) and Idaho (Lloyd Oldenburg). Those two states will send a copy of their antelope depredation guidelines to the other pronghorn province/state representatives for review prior to the 14th workshop.

New Business

I. Trapping and Translocation Guidelines

Following a general discussion of methods currently used, the group agreed that the current guidelines need revision. Ray Lee (Arizona) believes Arizona's procedures are up-to-date and they are in written form as direction for their biologists. This would be a good document on which to base a revision of the current trapping and translocation guidelines. A three member group consisting of Bart O'Gara (Montana), Ray Lee (Arizona), and Mitch Willis (Oregon) agreed to tackle this revision.

II. Host for the 14th Workshop (1990)

Tom Pojar offered to host the 14th Pronghorn Antelope Workshop in Colorado. This was unanimously approved by the attending delegates.

The business meeting was adjourned at 4:40 p.m.

Respectfully submitted,

Al Polenz
for Workshop Chairman Dan Eastman