State of California
Natural Resources Agency
Department of Fish and Game

2012 California Pronghorn Antelope Status Report and Management Plan Update

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California Department of Fish and Game, Big Game Program

Photo by Mike Carpenter, USFWS, Sacramento NWR

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Table of Contents

I. Introduction

The history of pronghorn antelope in California is a story of boom to bust. Prior to the early 1800's their numbers are estimated to be as high as 500,000 in California, and they inhabited most parts of the state except for the higher mountain ranges and the north coast (CDFG 1982). At that time the greatest densities of pronghorn antelope were found in the San Joaquin Valley (Yoakum 2004a). It was originally thought that two subspecies of pronghorn antelope occurred historically in California; the Oregon pronghorn antelope, *Antilocapra americana oregona*, and the desert pronghorn antelope, *Antilocapra americana peninsularis*. By 1932 the desert pronghorn antelope was extirpated from the southern deserts of California (Pyshora 1977). More recent mitochondrial DNA and allozyme analyses (Lee 1992) have found that *A. a. oregona* are not genetically distinct from *A. a. americana*. Thus all populations of pronghorn antelope in California should be considered *A. a. americana* (O'Gara and Janis 2004).

A dramatic decline in pronghorn antelope numbers began with the California gold rush of 1849 and associated market shooting, and continued with agricultural and urban development. By 1923 only about 1,000 pronghorn antelope remained in California. Between 1923 and 1982, due in large part to protection from overhunting, decreased livestock grazing, and the emergence of wildlife management based on science (Yoakum 2004a), the pronghorn antelope population increased to nearly 8000 animals, found primarily in the northeastern part of the state. In 1982 a small group of about 100 pronghorn antelope also existed in Mono County, a result of transplanting animals from northeastern California in 1947 and 1949-50 (Pyshora 1977, CDFG 1982).

The Pronghorn Antelope in Northeastern California was a report written by Pyshora (1977), which described the status and issues concerning California's pronghorn antelope. This document recognized that a formalized plan was needed to manage the pronghorn antelope in California, and in 1982 the California Department of Fish and Game (CDFG) completed a *Pronghorn Antelope Management Plan*, authored by Northern Region wildlife staff. The plan covered all topics relevant to pronghorn antelope at the time, and included individual objectives and strategies for each herd designed to insure their productivity (CDFG 1982).

Three decades have passed since the writing of the Pronghorn Antelope Management Plan, and some of the information contained in the document is in need of revision. The purpose of this report is to document the current status of pronghorn antelope in California, update portions of the 1982 management plan, and describe changes that have occurred to this unique species and their habitats since the early 1980's. It is the hope of the author that this document will be used in future land use decisions, to give pronghorn antelope fair and

deserving consideration during planning of projects and other changes that may impact this and other wildlife species that occupy the range.

Current Distribution and Status

Pronghorn antelope range in numbers from over 4,000 animals in northeastern California, where the majority of the state's population resides, to small remnant groups such as in San Benito County where pronghorn antelope were released but have slowly declined in number until they are on the brink of extirpation (Figure 1). Two interstate herds are shared with Nevada, one in Surprise Valley, Modoc County and a small isolated herd of approximately 150 animals in the Bodie Hills area, Mono County. There is also an interstate herd that winters in the Clear Lake area of California and summers in Oregon. Due to an aggressive translocation effort during 1987 - 1990 prompted by crop depredation issues in northeastern California (O'Gara and Morrison 2004) several small herds exist in various locations throughout the state. The reintroduction efforts were successful in establishing pronghorn antelope in historical ranges where no animals had existed for decades. Currently each of these herds contains no more than 50 animals, several far less. Detailed descriptions of each of these herds are provided in Section III, page 30.

The northeastern portion of the state currently supports a population of approximately 4,100 animals that occur primarily in Modoc, Lassen, Siskiyou, and Shasta Counties. While there was a sharp decline in numbers (from 7-8,000 in 1992 to about 5,000 in 1993) resulting from the winter of 1992/93, the overall population level has been fairly stable since about 2000.

Relocation of pronghorn antelope within northeastern California has been limited to 68 animals that were removed from Goose Lake Valley Ranch in Modoc County in 1977 due to alfalfa depredation and released in Eastern Lassen County, and 29 animals that were captured in Butte Valley, Siskiyou County and released into the Skedaddle Mountains of Lassen County in 1982 (CDFG files).

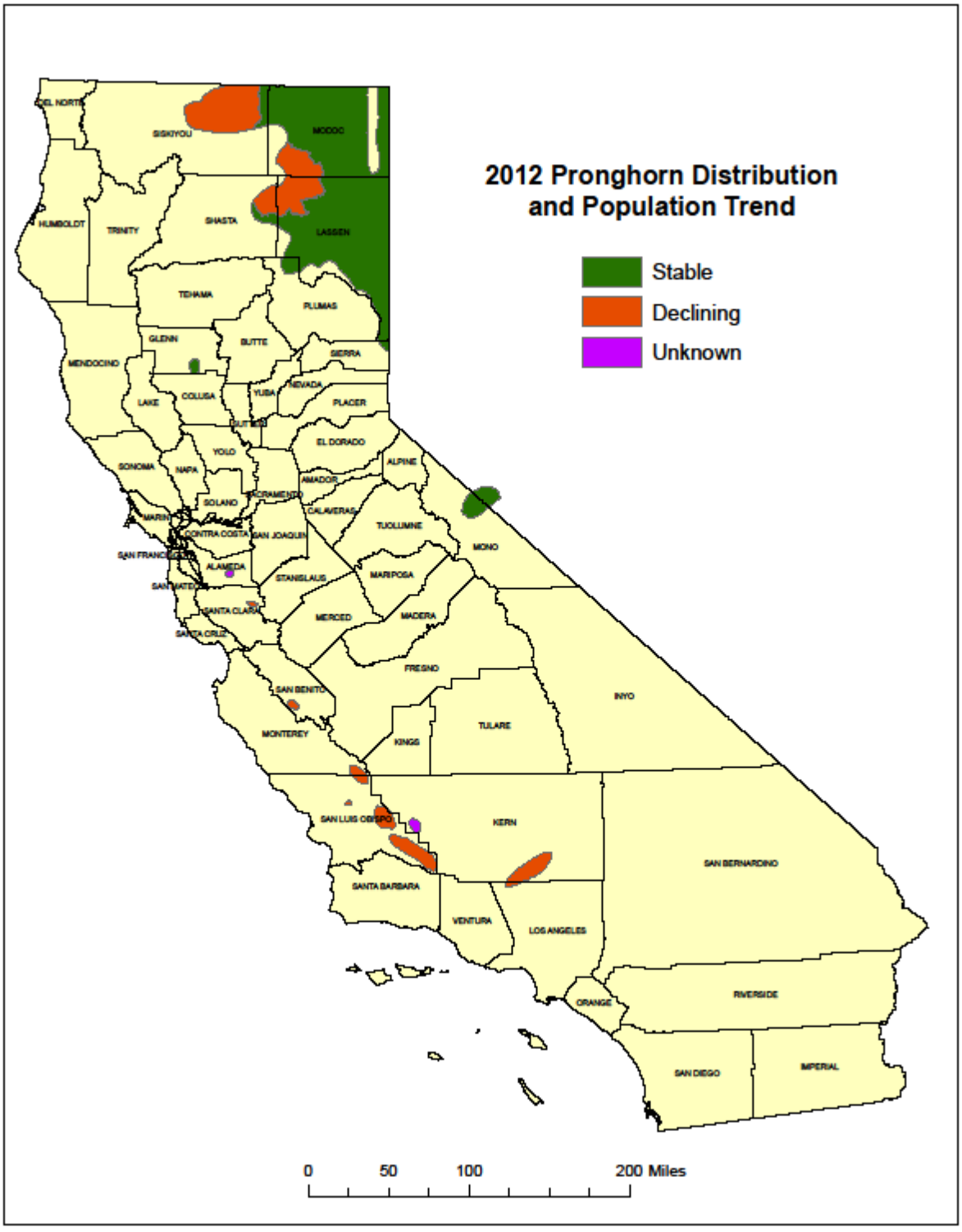

Figure 1. 2012 Pronghorn antelope distribution in California.

Despite substantial effort to expand the range of pronghorn antelope in California during the 1980's and 1990, overall numbers have declined over the past 20 years. Figure 2 shows the 1981 distribution of pronghorn antelope in northeastern California. The only other population existing in California at that time was in Mono County. Comparison of Figures 1 and 2 reveal only minor shifts in the distribution of pronghorn antelope in northeastern California since the early 1980's.

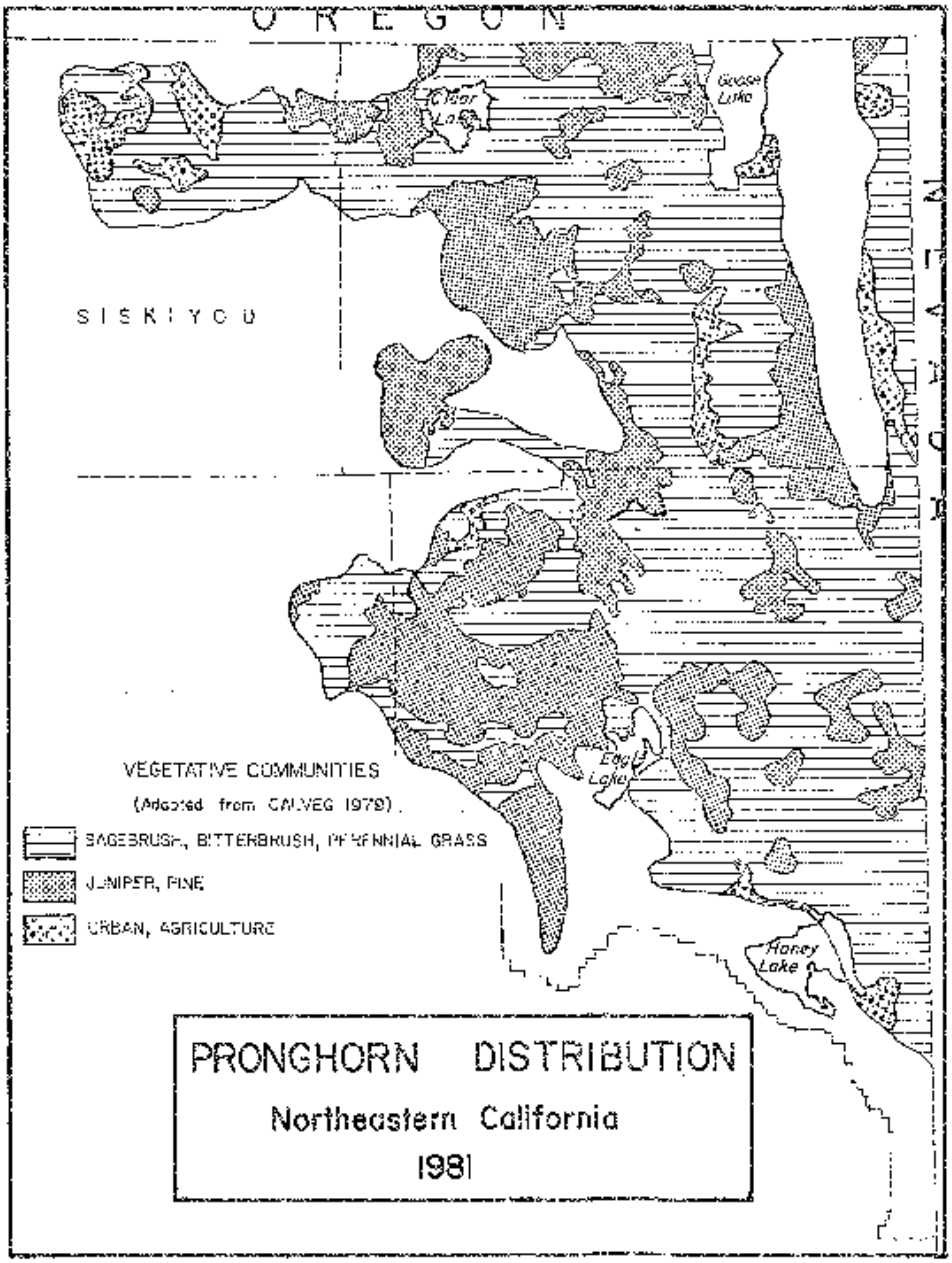

Figure 2. Northeastern California Pronghorn Antelope Distribution from the 1982 Pronghorn Antelope Management Plan

The main pronghorn antelope population in northeastern California supports a hunting program and is divided into 6 hunt zones, each with individual management strategies. Current information on this hunting program can be found on the Department's pronghorn antelope webpage (CDFG 2012). Except for very limited tags on Tejon Ranch in Southern California, all pronghorn antelope hunting in California is restricted to the northeastern population. This includes several private properties that are enrolled in the CDFG Private Lands Management Program. A limited public hunting program (2-5 tags annually) was conducted in the Carrizo Plain, San Luis Obispo County, from 1996 through 2001 but had to be discontinued due to declining pronghorn antelope numbers (CDFG files).

The Department's objectives are stated in the 2004 Environmental Document for Pronghorn Antelope Hunting as: "to maintain a healthy pronghorn antelope population statewide and provide biologically appropriate public hunting opportunities. The Department desires to maintain a population of 5,600-7,000 animals in northeastern California, 300 animals within the Carrizo Plains area, and a minimum of 100 animals within the Tejon Ranch area" (CDFG 2004).

II. Pronghorn Antelope of Northeastern California

When the Department's Pronghorn Antelope Management Plan was written in the early 1980s, the pronghorn antelope population in northeastern California had been climbing for a number of years. By 1990 the population exceeded 7,500, a level which was causing private property damage (there are no provisions for issuing depredation permits to take pronghorn antelope). To avoid further overpopulation resulting from mild weather conditions and artificially enhanced habitats (i.e. agricultural fields), the Department significantly increased the pronghorn antelope tag quota for northeastern California during 1990-1992 in an effort to reduce the population from over 7,500 to within a range of 5,600-7,000. Despite tag quotas that were more than double those of previous years, the northeastern California pronghorn antelope population did not decline until the winter of 1992-93 when extremely harsh weather conditions resulted in large over-winter losses (CDFG 2004). CDFG surveys indicate that more than one third of the total population was lost in that one season. The population did not rebound after the heavy loss, possibly indicating the herds were previously above carrying capacity of the range or that unknown factors such as disease, land use changes, or predation are playing an increased role in population demographics.

Since 1993 the northeastern California pronghorn antelope population has decreased slightly, but has remained stable for at least the past 10 years (Figure 3). However, population trends in each of the hunting zones vary, generally with declining numbers in the western portion of the range (Mount Dome area of Siskiyou County and the Big Valley area of Modoc, Lassen,

Siskiyou, and Shasta Counties), and increasing to the east in Lassen County near the Nevada state line. Other areas are holding stable, although the trend of the animals in the Surprise Valley area of Modoc County is unknown since that area is no longer surveyed (B. Ehler, CDFG, personal communication). Pronghorn antelope nearby in northwest Nevada also declined due to the 1992/93 winter, however they have been on the increase in the past decade (Cox et al. 2012, C. Hampson, Nevada Department of Wildlife, personal communication).

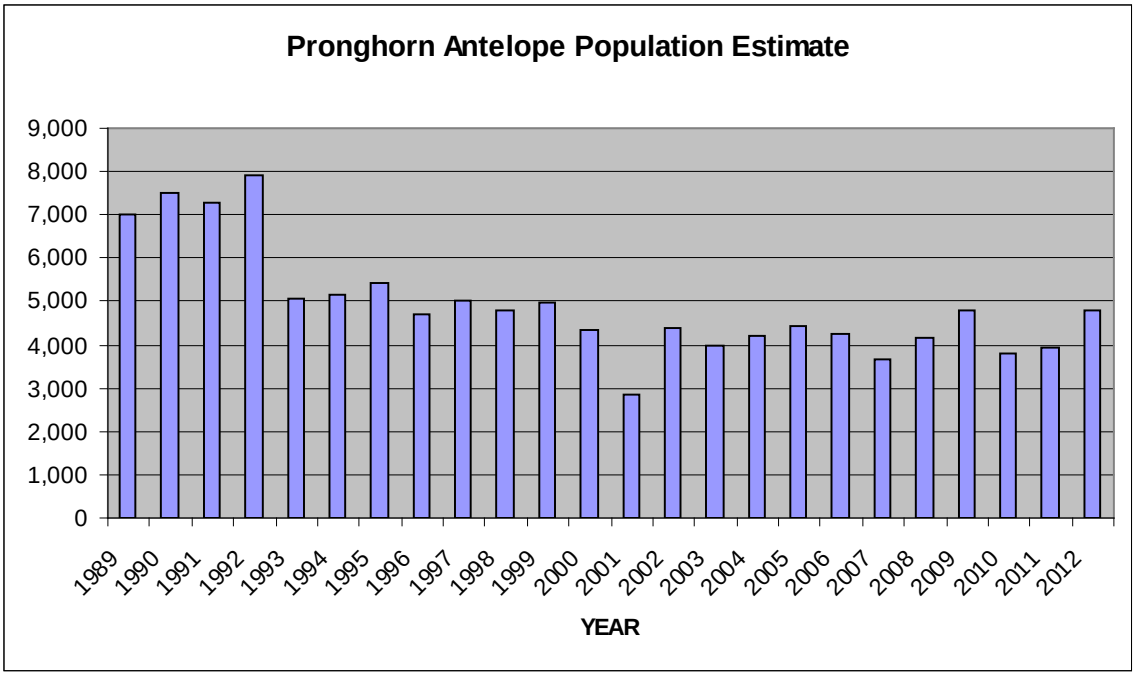

Figure 3. Estimated Population of Pronghorn Antelope for Northeastern California (CDFG files)

Pronghorn antelope surveys have been completed regularly since 1953, and until 1999 an aerial survey using fixed wing aircraft was attempted of all known winter ranges in Lassen, Modoc, Shasta and Siskiyou counties. Summer surveys to collect composition data were also conducted, but were discontinued beginning in 1999. At that time polygons (count blocks) were stratified to count 18 of the 29 previously identified winter range polygons that had the highest number of pronghorn antelope based on all surveys completed in 1953 through 1998. This stratification resulted in a set of polygons that averaged 97% of the total population based on the earlier surveys. This reduction in survey effort was done to reduce flight time, reduce costs, and improve flight safety without significantly reducing survey accuracy and utility. Population estimates were obtained by adjusting the numbers of pronghorn antelope counted by 3% to account for polygons not surveyed (DFG files).

This basic survey methodology had been followed since 1999, with some minor adjustments being made over time. Currently there are a total of 21 polygons surveyed, each being flown every other year. Hunt zones 1-3 and 4-5 are surveyed on alternate years. Zone 6 is not surveyed, but a 3% adjustment is made to the northeastern California population estimate to account for these animals (B. Ehler, personal communication).

The population estimates derived from annual winter surveys provide the basis for setting tag quotas for hunting pronghorn antelope in northeastern California. Hunting strategies are designed to achieve and maintain specific herd goals. The harvest strategy for northeastern California is calculated to allow the take of five to six percent of the population estimate based on the winter survey, and is intended to result in a post-hunt ratio of at least 24 bucks per 100 does. This is a very conservative harvest compared to most western states which harvest 10-25 percent of their entire population annually with no significant adverse effects (CDFG 2004). California has harvested a small percentage of the estimated population annually (Figure 4). Detailed harvest data from 1982 – 2011 are shown in table 1.

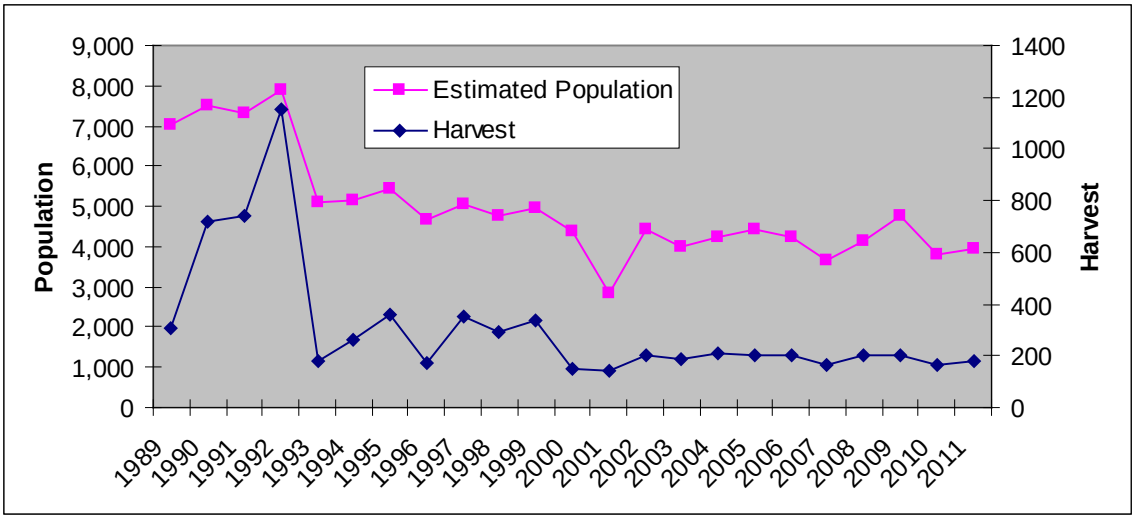

Figure 4. Comparison of population and harvest levels of pronghorn antelope in northeastern California (CDFG files).

Research on pronghorn antelope in northeastern California has been limited, with only one study initiated since the early 1980s. The CDFG Northern Region radio collared 3 pronghorn antelope in 2009 to acquire migration and other movement information, but these animals remained in the vicinity of an alfalfa field and did not migrate. Valuable information was acquired however, regarding immobilizing pronghorn antelope with drugs typically used on other ungulates. Telazol and Ketamine were ineffective even at high doses; instead synthetic narcotics were necessary to immobilize pronghorn antelope for collaring (B. Schaefer, personal

Annual Harvest for Pronghorn Antelope Hunts in California, 1982 - 2011

Year	Total Harvest	General						Archery Only	Big Valley Jr. Hunt	Lassen Jr. Hunt	Surprise Valley Jr. Hunt	Likely Tables Apprentic	Carrizo Hunt
		Mt. Dome	Clear Lake	Likely Tables	Lassen	Big Valley	Surprise Valley						
1982	497	99	71	167	74	51	18	17					
1983	448	48	69	155	94	40	26	16					
1984	429	72	65	192	18	51	14	17					
1985	411	60	82	95	110	32	11	21					
1986	505	33	148	131	103	49	18	23					
1987	552	65	158	141	104	53	12	19					
1988	528	78	98	160	109	46	8	29					
1989	303	9	65	148	23	16	24	18					
1990	744	72	70	240	246	49	40	27					
1991	753	76	74	229	244	61	38	31					
1992	1167	107	114	353	402	107	41	35	8				
1993	191	17	19	55	57	14	13	6	5	5			
1994	266	25	24	83	84	23	11	10	1	5			
1995	367	34	36	125	119	23	10	13	3	4			
1996	186	17	18	58	57	8	8	5	5	5			5
1997	360	33	35	110	127	24	11	10	5	2			3
1998	294	20	19	114	104	12	12	9	0	2			2
1999	344	29	23	128	116	17	12	10	2	2			5
2000	155	4	11	57	56	9	10	3	1	2			2
2001	148	2	9	59	55	6	9	3	2	2			1
2002	203	5	10	81	81	5	10	8	1	2			
2003	189	5	11	76	73	6	10	4	2	2			
2004	214	5	13	86	77	6	9	10	2	4	2		
2005	213	7	12	82	75	6	10	12	2	4	3		
2006	214	7	12	93	77	1	8	7	1	4	4		
2007	177	7	12	66	65	3	7	7	1	5	4		
2008	186	6	11	66	72	3	6	12	1	5	4		
2009	207	5	11	81	81	7	7	8	1	4	2		
2010	176	0	8	59	78	6	8	8	1	1	2	5	
2011	194	0	8	60	88	8	7	11	1	5	4	2	
	Does not include PLM or Fund Raising Tags												

Table 1. Pronghorn antelope harvest 1982 – 2011, by hunt area (DFG files).

communication.) Currently a large scale study is planned that is designed to increase the knowledge of northeastern California pronghorn antelope. Implementation of the project is expected soon.

The following sections address a number of topics that describe the ranges of the northeastern California pronghorn antelope and factors that may be influencing their populations.

Forage and Cover

Autenrieth et al. (2006) describe pronghorn antelope as selective, opportunistic foragers that feed on the most palatable grasses, forbs, shrubs, and trees available. They favor habitats containing a mixture of vegetation that satisfy forage requirements and provide adequate fawn bedding cover (Yoakum 2004b). In northeastern California forbs and shrubs comprise the majority of the diet. Forbs are used at any time of year they are available, however summer is a critical time for forb consumption because does are nursing fawns and are in need of additional nutrients (CDFG 1982, Autenrieth et al. 2006). Shrubs are also often consumed throughout the year, although their nutritional value is generally better in the fall and winter. This is the time of year when pronghorn antelope use of shrubs is greatest. In addition, shrubs are often available even with deep snow and during years of drought. In these conditions lesser preferred shrubs are more often used because other more nutritional forage is scarce (CDFG 1982, Autenrieth et al. 2006). Grass is consumed most when it is young, green, and highly nutritious, but gets little use when it is dry (Autenrieth et al. 2006).

The pronghorn antelope depends on its excellent eyesight and exceptional speed to avoid predators. Because of this, rangelands with plants averaging 15 inches in height are generally favored over communities more than 30 inches tall (Yoakum 2004b), however in northeastern California pronghorn antelope are sometimes found in juniper/sage/bitterbrush landscapes where juniper provides high vegetative cover. This occurs primarily on summer ranges, and extensively in the Devil's Garden area of Modoc County where western juniper *(Juniperus occidentalis)* is prevalent (R. Schaefer, personal communication). Yoakum (2004b) mentioned that pronghorn antelope in California and Arizona sometimes use open juniper stands which can provide succulent forage. These more forested areas also provide shade in the summertime.

Northeastern California pronghorn antelope winter range is primarily sage habitat, with low sagebrush *(Artemisia arbuscula)* and big sage *(Artemisia tridentata)* serving as the predominant shrubs, and bitterbrush *(Purshia tridentata)* occurring in limited amounts. Other common vegetative species are rabbitbrush *(Chrysothamnus nauseosus)*, saltbush *(Atriplex* spp.*)*, tumbling mustard *(Sisymbrium altissmum)*, and cheatgrass *(Bromus tectorum)*. Some perennial grasses that occur in smaller amounts are squirrel-tail *(Elymus elymoides)*, bluebunch wheatgrass *(Pseudoroegneria spicata)*, and fescue

(Festuca spp.*)*. Summer range varies and may include dry meadow habitat with perennial grasses, sedges *(Carex* spp.*)*, annual forbs, and sage *(Artemisia* spp.*)*. Other summer ranges consist of juniper/sage, sage/grassland, wet meadows, large vernal ponds, grass/forb habitats, and some cultivated crops, such as alfalfa (CDFG 1982). Plant productivity and resultant carrying capacity for pronghorn antelope and other wildlife can vary significantly from one year to the next as a result of climatic conditions (CDFG 2004).

Throughout California habitat changes are continually occurring for a variety of reasons, many related to habitat succession. Habitat succession involves the progressive growth and replacement of different plant assemblages over time, ultimately resulting in a final stable plant community. Pronghorn antelope prefer young shrubs, forbs, and grasses (referred to as early successional stages of vegetation communities), and thrive on habitat dominated by shrubs and herbaceous plant species that are succulent and nutritious. These early successional stage environments are not as stable as late or final stage habitats, and they rely on fire or some other type of disturbance to return them to an early successional stage.

Pronghorn antelope depend on shrubs for both cover (especially during inclement weather and for hiding fawns) and forage. Due to a history of fire suppression and excessive livestock grazing, many Great Basin shrublands have become senescent (Gruell 1996) and do not supply the nutrition that plants of an earlier successional stage do. Rather than resetting shrub succession, fuel buildup supports high intensity fires that typically convert the remaining shrublands to vegetation communities dominated by annual grasses. For decades there has been a trend of increasing cheatgrass (*Bromus tectorum*) at the expense of primary browse plants such as sagebrush and bitterbrush. The cumulative effect is declining habitat quality on thousands of acres in both California and Nevada. Wildfire is the main cause as burned areas are typically recolonized by cheatgrass, especially on the more xeric south and west facing aspects (Clements and Young 1997, C. Hampson, personal communication).

In other areas the spread of juniper is displacing key shrub species (Gruell 1996). Schaefer et al. (2003) conducted a study examining changes in ground-cover, tree overstory, and distribution of Great Basin plant species on 69 permanent transects in the Devil's Garden, Modoc County, from 1957 to 1988. The results showed an increase in tree overstory for all years and a decrease in live shrubs. Most notable was the proliferation of western juniper, as it was the only species to show an increase in all aspects measured (ground-cover, overstory, and distribution). Annual percent cover of juniper increased from 2.1% in 1957 to 10.2% in 1998, a nearly 500% increase.

While pronghorn antelope sometimes use ranges containing juniper in northeastern California, the progression of juniper is altering important habitats to the detriment of pronghorn antelope and other wildlife. Reduction of shrubs and

herbs important to wildlife is characteristic of establishment and progression of western juniper stands. In addition to competition from tree overstory, shrub stands in the Devil's Garden have shown to be undergoing a lack of reproduction and increase in senescence. These trends, combined with cheatgrass invasion, are reducing the vigor and resilience of these habitats. Shrub-dependent wildlife populations appear to have been affected by changes in shrub cover in the Devil's Garden (Schaefer et. al 2003), and are likely impacted in other areas as well.

An additional factor influencing the sagebrush habitat in northeastern California is the establishment of new agriculture in areas formerly vegetated by native sagebrush scrub. The reduction of natural habitat and growth of crops attractive to pronghorn antelope may cause disproportional use of agricultural fields. While crops can provide supplemental forage, this situation also causes problems associated with increased roads such as collisions with vehicles and increased poaching. Landowner tolerance of pronghorn antelope presence and crop foraging varies, but depredation issues can result. Plantings of alfalfa in particular are preferred, and some herds in northeastern California use alfalfa on a regular basis. Changes in crops to those incompatible with pronghorn antelope may result in population declines where alternative forage is not available year-round.

Land Ownership

The pronghorn antelope range of northeastern California covers over 6 million acres. Approximately 38% of this area is privately owned, while the balance is dominated by federal ownership, mostly the USDA Forest Service (USFS) and the Bureau of Land Management (BLM) (Table 2, Figure 5).

CALIFORNIA OWNERSHIP	ACRES	PERCENTAGE
Private	2,303,848.80	37.67%
United States Forest Service	2,114,640.62	34.58%
United States Bureau of Land Management	1,377,261.39	22.52%
United States Fish and Wildlife Service	113,397.65	1.85%
California Department of Fish and Game	76,403.22	1.25%
United States National Park Service	46,841.53	0.77%
United States Department of Defense	32,550.12	0.53%
California State Lands Commission	25,992.06	0.43%
Bureau of Indian Affairs	10,222.66	0.17%
United States Bureau of Reclamation	9,127.28	0.15%
Other State Lands	4,141.04	0.07%
Local Government	1,309.20	0.02%
TOTAL	6,115,735.57	100.00%

Table 2. Land Ownership of the Northeastern California Pronghorn Antelope Range. Data derived from CAL FIRE – FRAP California Multi-Source Land Ownership (ownership11_2), October 2011.

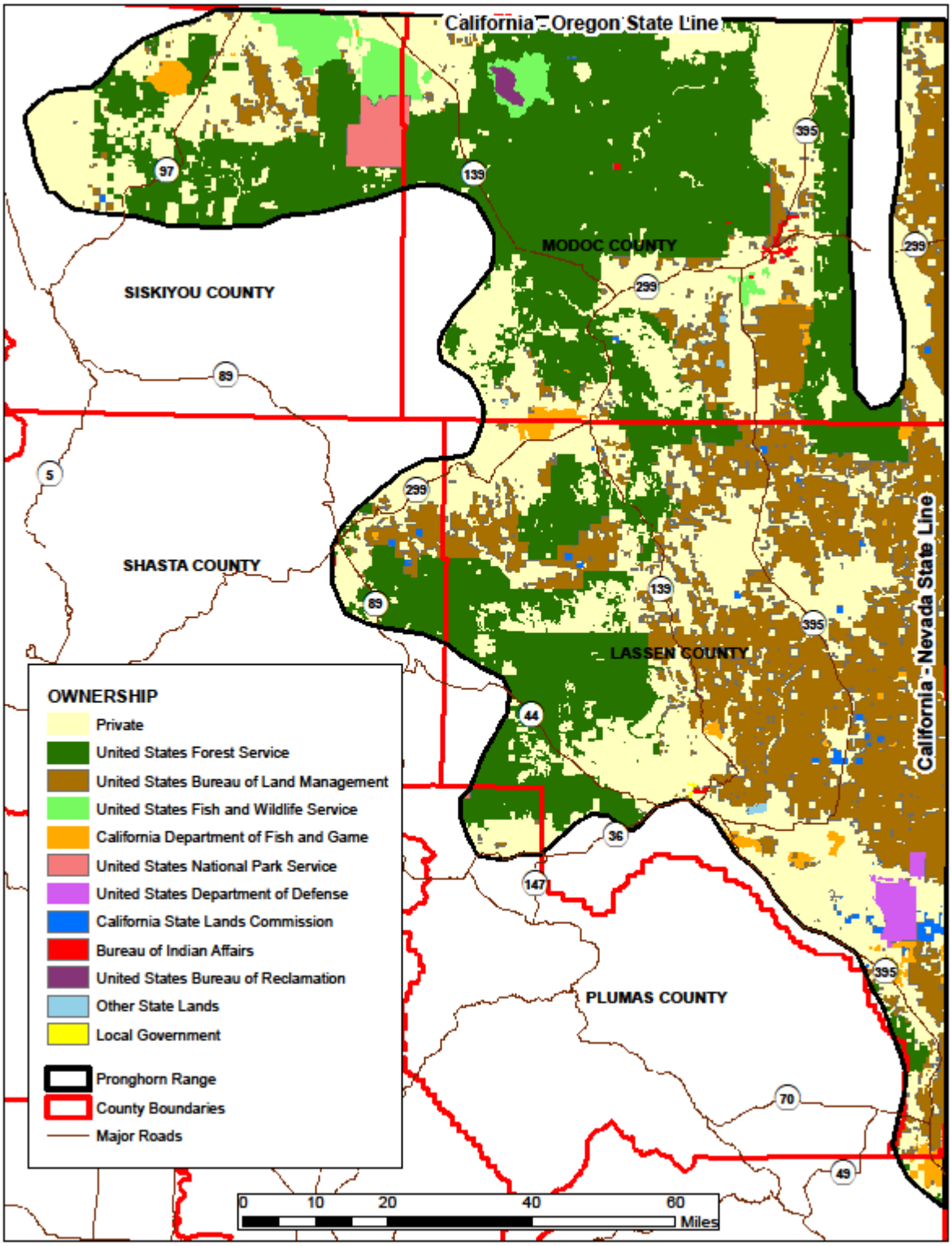

Figure 5. Land ownership of the Northeastern California Pronghorn Antelope Range, 2011.

Wildlife Areas

The following is a listing of CDFG owned Wildlife Areas within the northeastern California pronghorn antelope ranges which provide habitat of varying importance for these animals. This represents a total of 31,790 acres that are under CDFG control and potentially available for habitat projects.

- Pine Creek Wildlife Area in Modoc County is 2,009 acres of critical pronghorn antelope and deer winter range which contains a 25 acre reservoir.

- Fitzhugh Creek Wildlife Area in Modoc County is 2,080 acres of wetland, riparian, and riverine habitat. The area is considered important winter and summer range for pronghorn antelope and deer.

- Ash Creek Wildlife Area in Lassen and Modoc Counties is 14,754 acres of pristine habitat that is used by pronghorn antelope and other wildlife species.

- Silver Creek Wildlife Area in Lassen County is 2,010 acres consisting of a mix of vegetation types including mixed conifer, sagebrush, meadow and riparian. This diversity of habitats supports numerous wildlife species.

- Willow Creek Wildlife Area in Lassen County is 2,722 acres of meadows, wetlands, and shallow marshes. The meadows provide habitat for pronghorn antelope and upland species.

- Biscar Wildlife Area in Lassen County is 548 acres of sagebrush covered uplands that includes two small reservoirs. The area supplies water and vegetation that is used by pronghorn antelope and other wildlife.

- Honey Lake Wildlife Area in Lassen County is composed of 7,667 acres of sagebrush surrounding a shallow lake in the Great Basin Desert. Pronghorn antelope, deer, and many species of birds use this area.

Vegetation/Land Cover

Within the 6 million+ acres of pronghorn antelope range in northeastern California, the most common habitat type is sagebrush. The combination of sagebrush and low sage habitat types makes up over 38% of the range. Table 3 is a complete list of habitat types composing the range.

The general land cover types that characterize the habitat of the pronghorn antelope range in northeastern California are illustrated in Figure 6. Using the 2006 National Land Cover Database, the shrub/scrub classification is shown as

the most extensive, covering approximately 44% of the range. The next most common land cover type is the Evergreen Forest at 27%.

HABITAT TYPE	ACRES	PERCENTAGE
SAGEBRUSH	1,864,321.08	30.5469%
EASTSIDE PINE	775,235.59	12.7022%
JUNIPER	657,802.55	10.7781%
LOW SAGE	494,594.22	8.1039%
SIERRAN MIXED CONIFER	420,244.78	6.8857%
Cropland	396,339.51	6.4940%
LACUSTRINE	248,062.69	4.0645%
PERENNIAL GRASSLAND	154,089.09	2.5247%
ANNUAL GRASSLAND	145,092.18	2.3773%
WET MEADOW	135,626.95	2.2222%
MONTANE CHAPARRAL	133,245.70	2.1832%
BITTERBRUSH	104,791.95	1.7170%
ALKALI DESERT SCRUB	99,187.93	1.6252%
BARREN	91,497.01	1.4992%
PONDEROSA PINE	77,522.51	1.2702%
WHITE FIR	69,170.46	1.1334%
MIXED CHAPARRAL	59,832.48	0.9804%
LODGEPOLE PINE	41,109.83	0.6736%
PASTURE	41,002.07	0.6718%
RED FIR	40,698.50	0.6668%
MONTANE HARDWOOD	15,056.83	0.2467%
MONTANE HARDWOOD-CONIFER	10,850.06	0.1778%
MONTANE RIPARIAN	7,664.78	0.1256%
JEFFREY PINE	7,264.80	0.1190%
ASPEN	5,901.82	0.0967%
URBAN	3,916.48	0.0642%
SUBALPINE CONIFER	2,322.55	0.0381%
FRESH EMERGENT WETLAND	279.37	0.0046%
BLUE OAK-FOOTHILL PINE	220.45	0.0036%
No Eveg Data	98.98	0.0016%
VINEYARD	45.85	0.0008%
DECIDUOUS ORCHARD	32.99	0.0005%
ALPINE DWARF-SHRUB	23.57	0.0004%
DOUGLAS-FIR	3.86	0.0001%
BLUE OAK WOODLAND	3.00	0.0000%
RIVERINE	0.21	0.0000%
TOTAL	6,103,152.66	100.0000%

Table 3. Percentage of vegetation types in the northeastern California Pronghorn Antelope Range. Data source: Existing vegetation (Eveg), USDA Forest Service – Pacific Southwest Region – Remote Sensing Lab.

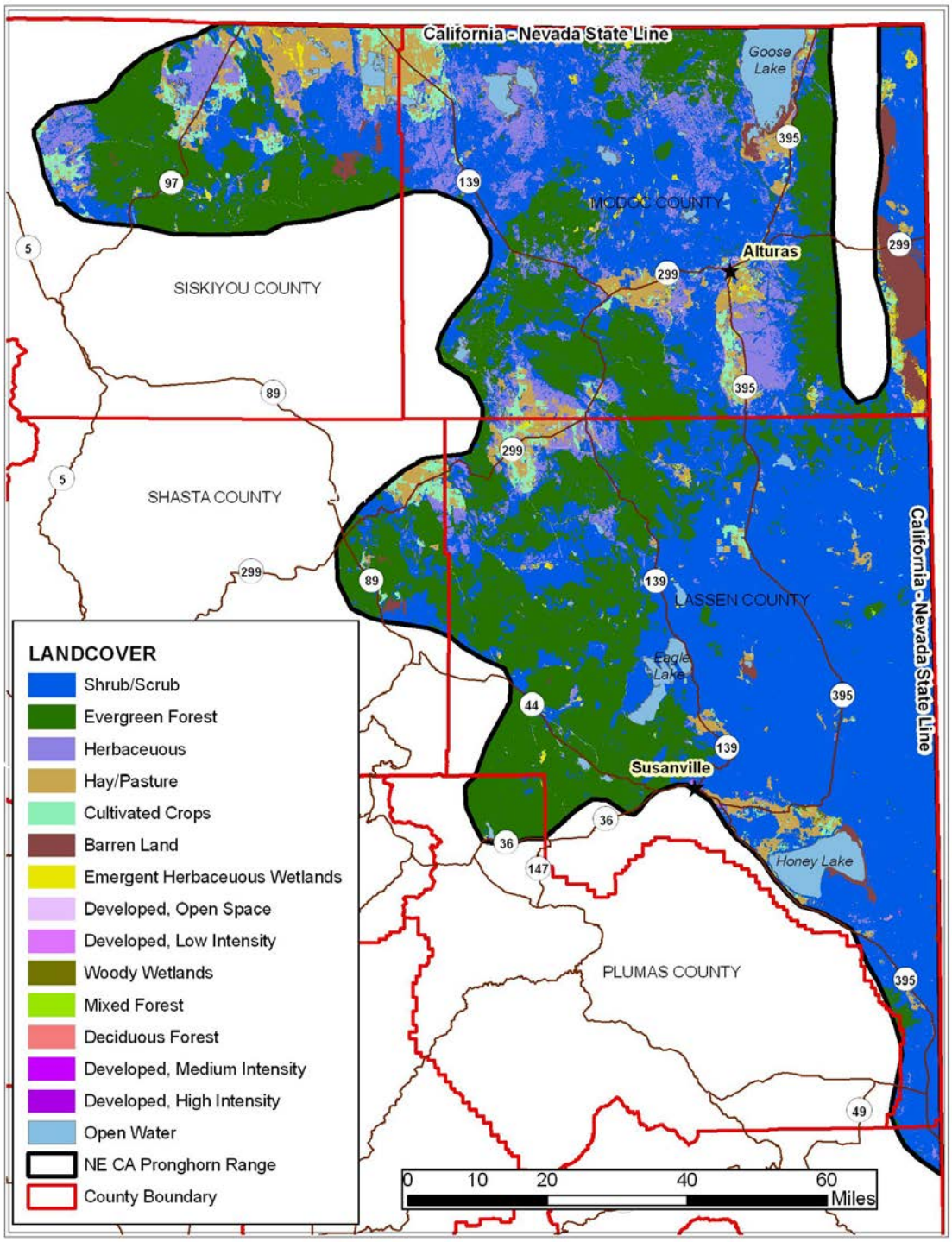

Figure 6. Land Cover types of the Northeastern California Pronghorn Antelope Range. Data Source: U.S. Geological Survey 2006 National Land Cover Database remote sensing imagery. Publication Date: Feb. 16, 2011.

Migration and Seasonal Ranges

Pronghorn antelope move to different locations for a number of reasons including heavy snowfall, drought, disturbance, and availability of forage or water (Autenrieth et al. 2006). Pronghorn antelope in northeastern California are for the most part migratory, however during mild winters they sometimes use summer and/or transitional ranges all year. Migration may only consist of shifts in elevation and exposure, or pronghorn antelope may travel up to 70 miles to reach their seasonal ranges (Pyshora 1977, CDFG 1982).

Fall migrations typically are initiated by the first snow producing storms, and a major weather event can cause a quick departure from summering areas. Conversely spring movements to summer range are usually a slower and more gradual progression. Pronghorn antelope use specific migration corridors to move from summer to winter range and do not normally deviate from these paths. These migration corridors are therefore a crucial element of the overall range, and are especially prone to impacts from fencing, housing, and other types of development (CDFG 1982).

Pronghorn antelope does typically leave normal summer range areas to isolate themselves prior to giving birth (Autenrieth et al. 2006, Pyshora 1977). By mid-summer, does and fawns are normally grouped together separately from the bucks. During this time non-territorial bucks form bachelor herds, while individual mature bucks are often territorial or attempt to maintain a harem (Autenrieth et al. 2006).

Recent data on migration routes and seasonal use areas for the pronghorn antelope of northeastern California are lacking, however maps were developed in the 1970's showing pronghorn antelope fawning grounds, migration corridors, stress migration corridors, and winter range. These areas were designated by DFG wildlife biologists based upon their personal knowledge of these ranges. This project was part of what was then known as the Areas of Significant Biological Importance (ASBI) project performed by Jones and Stokes in 1979. Under this project unit wildlife biologists were asked to hand draw natural resource boundaries and other resource features on USGS 7.5' and 15' quadrangle maps. These features were subsequently digitized to produce this dataset (Figure 7). A qualitative review of these data in 2001 by CDFG Environmental Scientist Robert Schaefer indicated that this dataset was coarse but accurate. Telemetry studies using modernized GPS techniques will be required for detailed refinement of habitat use and landscape linkages utilized by pronghorn antelope. The importance of completing this work is becoming increasingly relevant to the persistence of pronghorn antelope as expanding human population growth creates environmental stressors on pronghorn antelope populations and their habitats.

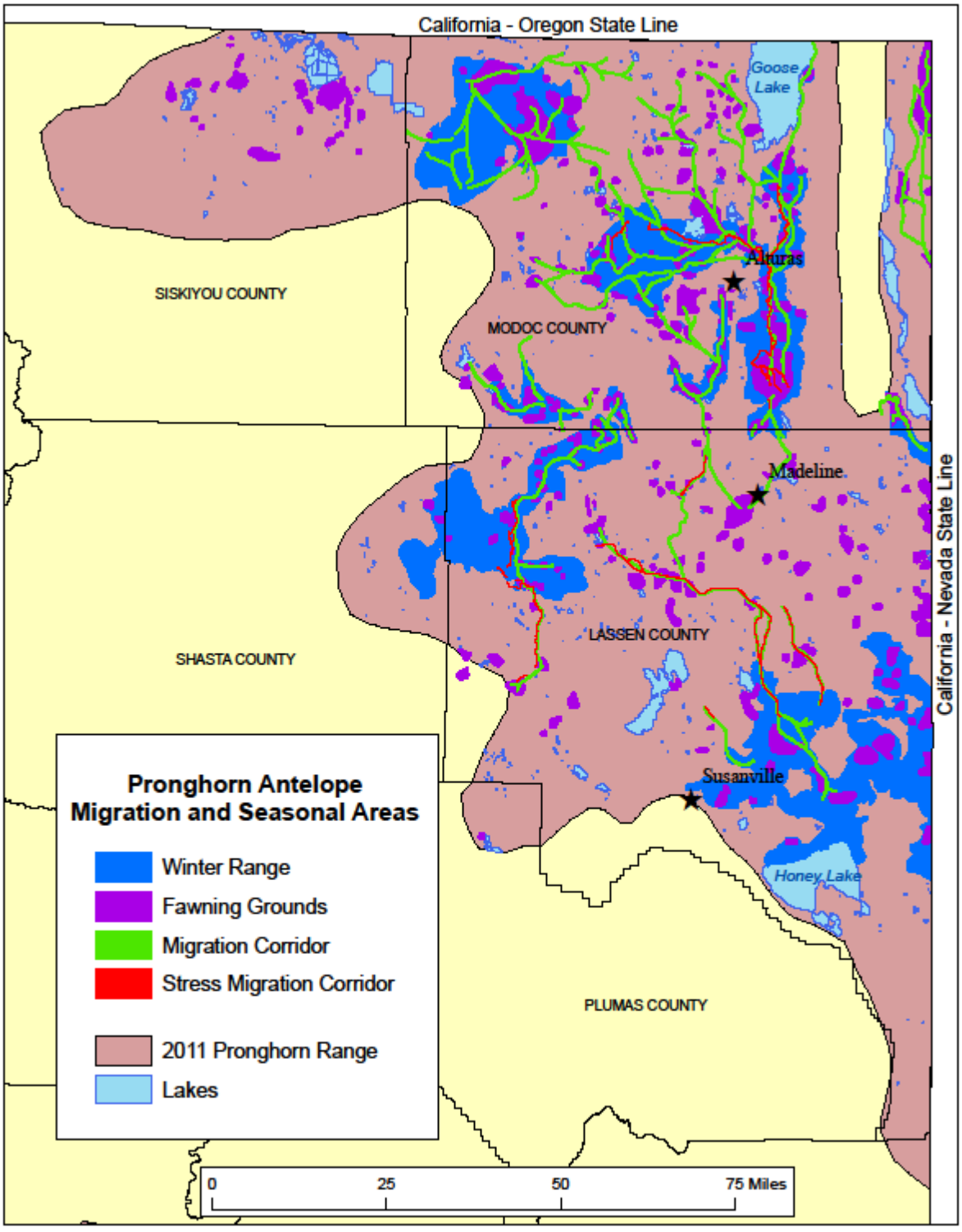

Figure 7. Northeastern California Pronghorn Antelope Seasonal Areas and Migration Routes. Source: Department of Fish and Game, Northern Region

Figure 8 illustrates the proportions of the 3 primary land owners on winter range, fawning grounds, and all pronghorn antelope range. BLM land appears to be preferred for winter and fawning, with less use of private and USFS owned land.

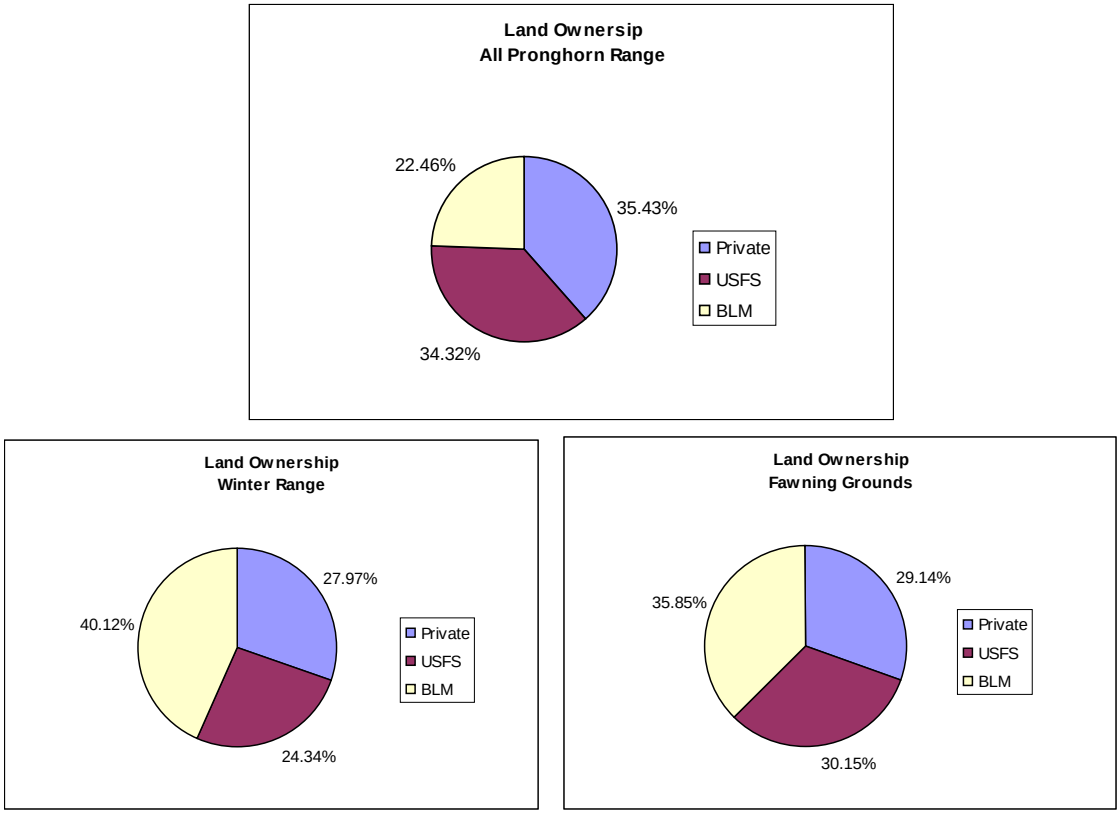

Figure 8. Primary land ownership of pronghorn antelope ranges. Source: CAL FIRE – FRAP California Multi-Source Land Ownership (ownership11_2), October 2011, and CDFG Pronghorn Antelope Migration and Seasonal Areas (1979).

Fire

Despite active fire suppression efforts, fire is a common occurrence on the pronghorn antelope ranges in California. On spring and summer ranges, pronghorn antelope may be drawn to burn areas to feed on newly emerging forbs, in some cases temporarily abandoning their normal ranges. In some instances, fire can be used to reduce decadent shrubs and increase herbaceous plants to benefit pronghorn antelope (Yoakum 2004d). However fire is generally a destructive force on winter range areas in California (CDFG 1982), commonly converting preferred shrubland to grassland less suitable for pronghorn antelope. Sagebrush species are slow to recover after fire, and will only grow under suitable conditions. Other low quality forages such as cheatgrass and rabbitbrush are more likely to become established after winter range fires (CDFG 1982).

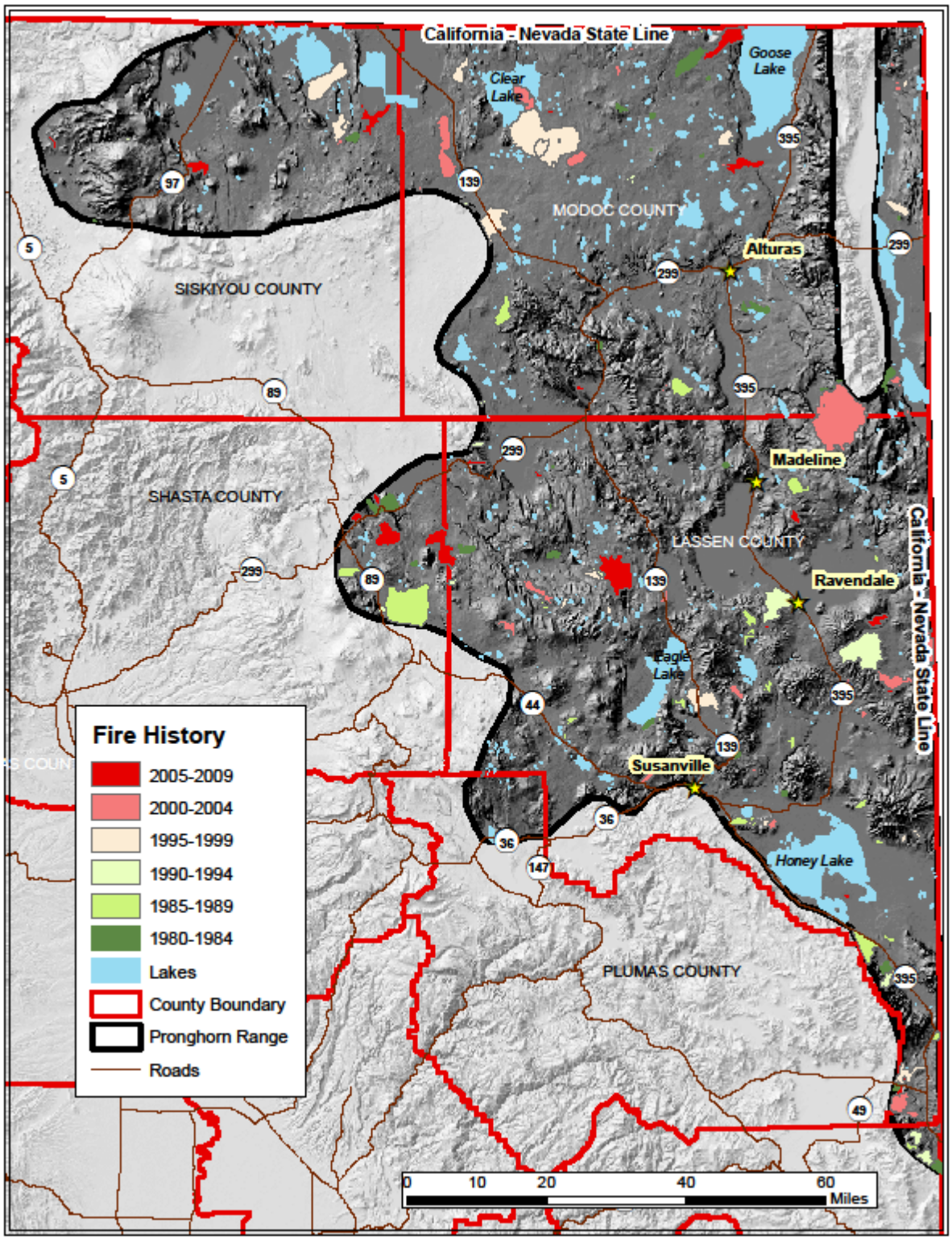

Figure 9. Fire History of the Northeastern California Pronghorn Antelope Range. Data source: Fire Perimeters (fire09_1), frap.cdf.ca.gov

Fire in sagebrush plant communities not only destroys brush forage species, but also opens the way for invasive plants such as cheatgrass to become established. Cheatgrass is an exceptionally competitive annual grass due to its early germination in the fall and winter, well developed root system for water uptake, abundant seed production, and extended seed dormancy. This grass takes over after fire and out-competes brush and other grasses. Cheatgrass also provides a fine textured, early maturing fuel that may increase the incidence of fire (deVos et al. 2003). In many areas pronghorn antelope range condition has declined since the 1980's, primarily as a result of fire converting browse to cheatgrass (B. Ehler, personal communication). Figure 9 shows the locations of fires that burned in the years 1980-2009 within the northeastern California pronghorn antelope range. In the summer of 2012 a massive fire of over 300,000 acres, mostly in Lassen County, burned additional pronghorn antelope habitat. The impact of this fire to pronghorn antelope is currently unknown but is expected to be negative due to the high probability of destruction of sagebrush shrubs and conversion to cheatgrass.

Grazing Competition

Pronghorn antelope are often in competition with other grazing animals, most often livestock and wild horses in northeastern California. Competition occurs when a resource, usually forage, is not abundant enough to support all animals using it, resulting in negative impacts to the resource as well as to one or more species utilizing it. These impacts may present themselves as changes to a species numbers, spatial distribution, or biology. Competition can be light or intense, depending on factors such as geographic area, type of plant community, foraging intensity, and pressure by herbivorous users (Yoakum 2004c).

The vast majority of pronghorn antelope share their rangelands with livestock at some time during the year, and without careful management considering all species present competition for forage, water, space, and shelter may result. Potential impacts of livestock competition include seasonal or annual removal of forage, reduction in concealment cover for fawns, changes in plant diversity, and modification of botanical species composition which may lead to long term changes in plant communities. It is possible that the two most significant impacts of livestock grazing on pronghorn antelope populations are changes in plant succession and decrease in suitable fawning habitat (Yoakum 2004c). Livestock grazing is the most ubiquitous economic activity occurring on northeastern California pronghorn antelope ranges, and its importance to the health of pronghorn antelope herds must not be underestimated.

Domestic livestock grazing is a primary use of both public and private lands in northeastern California. There are livestock grazing allotments on virtually all BLM and USFS land within the pronghorn antelope range in that portion of the state. When the Pronghorn Antelope Management Plan was written in 1982, livestock grazing on USFS and BLM grazing allotments had been reduced from a historical high level of overuse to a more moderate level of grazing. This was

largely due to the implementation of the National Environmental Policy Act (NEPA) in 1970, and the resulting assessment of the effects of grazing on Federal lands (R. Lim, Tahoe National Forest, personal communication). However, this decrease of grazing pressure on Federal lands did not result in favorable conditions in all areas. According to a 1981 BLM document, the range conditions at that time for the Cal-Neva Planning Unit were described as being 47 percent in poor condition, 47 percent in fair condition, only 6 percent in good condition and less than 1 percent in excellent condition (BLM 1981). Grazing overuse by livestock still occurs and is even more prevalent during low precipitation years (R. Schaefer, personal communication). Tsukamoto (1983) describes competition for water between pronghorn antelope and livestock in localized areas of Nevada's open range, which may become severe during drought conditions.

The measure of grazing used is an animal unit month (AUM), which is defined on the BLM grazing webpage as the amount of forage needed to sustain one cow and her calf, one horse, or five sheep or goats for a month (BLM 2012b). Patrick Farris, Rangeland Management Specialist for BLM, reported that livestock grazing pressure within the Eagle Lake Field Office area decreased substantially during 1967-1985. In that period there was a 40,000+ AUM reduction resulting from canceled grazing permits and eliminating unauthorized trespass use.

Current and historical (when available) grazing levels were collected from the Modoc National Forest and the three BLM Field Offices that occur within the northeastern California pronghorn antelope range. The number of AUMs on grazing allotments on the Modoc National Forest has decreased by 42,721 AUMs (34%) over the past decade. This is a significant reduction that was found on forest service land, but not BLM property during the same period. The general trend on BLM land has been no or very small decreases in AUMs since the 1980's. Between 1990 and 2010, modifications to livestock grazing permits by the Eagle Lake Field Office included changes in grazing strategy such as deferred and/or rotational grazing, movement of livestock based on utilization levels, and protection of riparian and spring areas, but no reduction to AUMs (BLM 2007). Table 4 summarizes the changes in livestock grazing pressure on federally owned land within the northeastern California pronghorn antelope range.

Office	Current AUMs	Historical AUMs	Source
Modoc National Forest	Authorized grazing allotments (actual use) = 84,179 AUM's	1991 authorized AUMs = 126,900	Jenny Jayo, Rangeland Management Specialist
BLM Eagle Lake Field Office	2011 total allotments CA and NV = 50,039 (approximately 40,000 AUMs in CA)	1982 total allotments (CA and NV) = 53,577 AUMs.	Patrick Farris, Rangeland Management Specialist
BLM Alturas Field Office	2007 Active AUMs = 52,114	1984 Active AUMs = 54,122	Alan Uchida, Rangeland Management Specialist
BLM Surprise Field Office	12,890 current active AUMs in CA	Numbers not available, however AUMs have not changed much since the 1980's	Steve Surian, Rangeland Management Specialist

Table 4. Grazing AUMs on northeastern California pronghorn antelope range.

In addition to livestock grazing allotments, there are wild horse and burro "Herd Management Areas" within pronghorn antelope range. By BLM's definition these are herd areas identified in an approved land use plan where wild horses and burros are maintained and managed (BLM 2012a). Within the range of California's pronghorn antelope, most of these areas are located in the eastern part of Lassen County, although there are smaller areas in Modoc and Siskiyou Counties as well.

Wild horses are serious competitors for water in some areas. Cox et al. 2012 and Tsukamoto 1983 describe competition between pronghorn antelope and feral (wild) horses in Nevada, resulting in conflicts that become acute during periods of drought. Wild horses are reported to cause damage to natural water sources, resulting in declines in functionality of the source, a decline in water quality, and elimination of surrounding vegetation. Horses may also act aggressively towards native ungulates, causing pronghorn antelope and other native species to seek alternative water sources (Tsukamoto 1983). These conflicts are similar in California, resulting in habitat degradation which is especially intense around water and wetland areas (B. Ehler, personal communication).

Impacts of wild horses and burros are significant in Modoc and Lassen counties where they occur sympatrically with native ungulates. These impacts are primarily due to the BLM's inability to keep wild horses and burros within stated population goals (R. Schaefer, personal communication). The BLM attempts to

keep horse and burro populations at an Appropriate Management Level (AML), which is defined as “the point at which wild horse and burro herd populations are consistent with the land’s capacity to support them”. However, as of February 2012 there were an estimated 37,300 wild horses and burros on BLM lands in 10 western states. This is about 11,000 (42%) over the AML of 26,500 (BLM 2012c).

Periodically the numbers of wild horses and burros in Lassen County reach levels several times the target AMLs. The Twin Peaks Herd Management Area (HMA) covers 789,852 acres, slightly over half in Lassen County and the rest in Washoe County, Nevada. The AMLs for this HMA are 448-758 horses and 72-116 burros (BLM 2010). Before the last gather (roundup and removal) of horses and burros in 2010, numbers had risen to approximately 2,303 horses and 282 burros, and had been increasing an average of 20% per year since the last gather of horses in 2006. At the pre-gather 2010 numbers, grazing use by wild horses exceeded the amount of forage allocated to them by 3 to 5 times. Use by wild burros exceeded allocations by 2.5 to 4 times (BLM 2010). After the 2010 gather the populations had been reduced to 793 wild horses and 160 wild burros (BLM 2011a), which slightly exceeds the high AML for each species.

The majority of the Twin Peaks HMA is generally arid, and receives only 7 – 10 inches of precipitation annually. The lack of consistently available drinking water is a limiting factor for wildlife in many areas, and this situation creates problems with vegetation and condition of water sources when wild horse and burro populations exceed the AMLs (BLM 2010). The BLM states that “due to animals concentrating near water sources, the degraded condition of riparian areas and wetland (spring) sites is a major resource concern in the HMA when wild horses and burro numbers are above the high AML range (BLM 2010).” Given that wild horse and burro numbers are typically above their AMLs, this promises to be an ongoing problem.

Human Population and Exurban Growth

Growth of the human population is an important factor to consider due to the need for resources that an ever-expanding population requires. Human related impacts often affect a wide variety of wildlife in numerous ways including displacement through habitat occupation, reducing habitat suitability by altering the physical characteristics of habitat, and displacement through disturbance, such as noise and activity (Sommer et al. 2007).

Displacement occurs when habitat is occupied by the construction of buildings, roads and other related development, or habitat is converted to another use such as agriculture. With these changes may come additional concerns to pronghorn antelope such as fences, livestock, and dogs. Increased roads can limit access to important habitats and increase mortality by vehicle collisions. Excessive livestock grazing may alter habitat suitability by removing forage and cover species that pronghorn antelope rely on. Other land uses such as energy

development and landfills can alter habitat suitability by changing vegetation composition and increasing new road installation. Where human encroachment occurs is often more important than the size of the disturbance. For example, changes to areas where key migration routes occur may have far reaching impacts to a pronghorn antelope herd.

Table 5 shows the human population change by decade in the counties that comprise the majority of the northeastern California pronghorn antelope area. County populations include numbers for the entire county, some of which may not occur within pronghorn antelope range. These data show that the counties that make up the bulk of pronghorn antelope range in California are generally lightly populated and slow growing, however human impacts still occur. In addition, small changes over time often result in cumulative effects that are significant to wildlife.

HUMAN POPULATION CHANGE BY COUNTY						
Population						
County	1960	1970	1980	1990	2000	2010
Lassen County	13,597	16,796	21,661	27,598	33,828	34,895
Modoc County	8,308	7,469	8,610	9,678	9,449	9,686
Siskiyou County	32,885	33,225	39,732	43,531	44,301	44,900

Percent Change of Population					
County	1970 to 1980	1980 to 1990	1990 to 2000	2000 to 2010	Total 40 year change
Lassen County	29.00	27.40	22.60	3.15	82.15
Modoc County	15.30	12.40	-2.40	2.51	27.81
Siskiyou County	19.60	9.60	1.80	1.35	32.35
Source: U.S. Census Bureau					

Table 5. Census data comparison by County.

Research conducted by Theobald (2005) indicates that residential development beyond the urban fringe, sometimes called exurban sprawl or rural residential development, has resulted in extensive and widespread changes to the landscape across the United States. As undeveloped rural areas are converted to exurban or possibly urban/suburban land use, natural resource values rapidly diminish. Theobald's work has shown that in the year 2000, nationwide exurban land use occupied slightly over seven times more area than urban and suburban densities. The developed footprint grew about 1.6% per year across the United States from 1980 to 2000, which exceeded the rate of population growth. These exurban areas are often located adjacent to or nearby protected lands, which may expose these lands to growth related impacts.

Theobald has produced a nationwide, fine-grained database of historical, current, and forecasted housing density, which can be used to quantify changes in growth patterns to infer possible ecological effects (Theobald 2005). This database was used to quantify habitat altered by development on the privately owned land within northeastern California pronghorn antelope range from 1960 to 2000 (Table 6 & Figure 10). The results show that undeveloped private land has decreased from 77% in 1960 to 61% in 2000, representing a loss or conversion of 345,493 acres (21%) of undeveloped private land. This acreage has been redistributed among the other three classes shown in the table below.

Development Class	1960 Percentage	1980 Percentage	2000 Percentage
Undeveloped private	77%	67%	61%
40 + acres per unit	22%	31%	36%
10 - 40 acres per unit	0.5%	1%	2%
Exurban/urban/built-up*	0.3%	0.5%	0.7%
*Exurban/urban/built-up = Up to 10 acres per housing unit, plus commercial, industrial, and transportation.			

Table 6. Percentages of development classes for selected years on privately owned land within the northeastern California pronghorn antelope range.

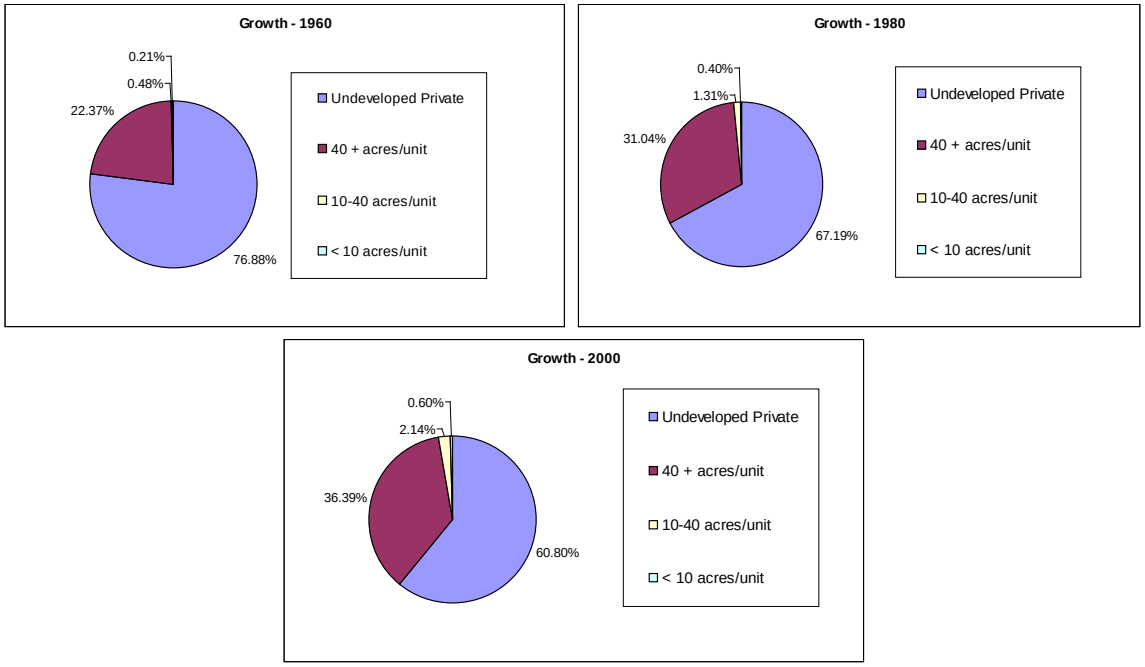

Figure 10. Exurban growth from 1960 to 2000.

In addition, the model used by Theobald to forecast future development predicts an increasing trend in all development within the northeastern California pronghorn antelope range in 2020 (Table 7). As these data illustrate, while northeastern California remains a less populated area of the state, exurban development is progressing and will likely increase in the future. Currently the trend is conversion of undeveloped land to small developments on large parcels (40+ acres). The more intensive development involving smaller parcel sizes is occurring primarily in the Susanville and Alturas areas.

Development Class	2020 Acreage	Percentage
Undeveloped private	1,211,902	56%
40 + acres per unit	860,708	40%
10 - 40 acres per unit	54,344	3%
Exurban/urban & Urban/built-up	21,557	1%
Total	2,148,510	100%

Table 7. Forcasted pattern of development classes for 2020.

Land Use Planning

The California Environmental Quality Act (CEQA) is a statute passed in 1970 that requires California state and local agencies to follow a protocol of analysis and public disclosure of the potential environmental impacts of development projects. Because CEQA makes environmental protection a mandatory part of every California state and local agency's decision making process, it has been somewhat effective in protecting the environment from some development related issues. Being involved with this process at the planning stage of projects is the best way to influence decisions that affect pronghorn antelope habitats. Even the best planned and mitigated development project often involves impacts to wildlife.

Figure 11 shows a GIS layer of combined County General Plans within the northeastern California pronghorn antelope range. A large portion of this area consists of open space and public land. Lassen County appears to combine this category with agriculture and grazing lands, which is reasonable since open space and public land typically are used for agriculture and/or grazing. While most of the area within pronghorn antelope range has little development, there exists more intensive development around towns such as Susanville and Alturas.

There has been a recent push for renewable energy development in California, particularly wind and solar energy. This is due in large part to the nationwide effort to become less dependent on foreign oil and reduce carbon emissions resulting from traditional energy sources such as oil, gas, and coal (Lutz et al. 2011). Areas of potential wind energy resources exist within pronghorn antelope

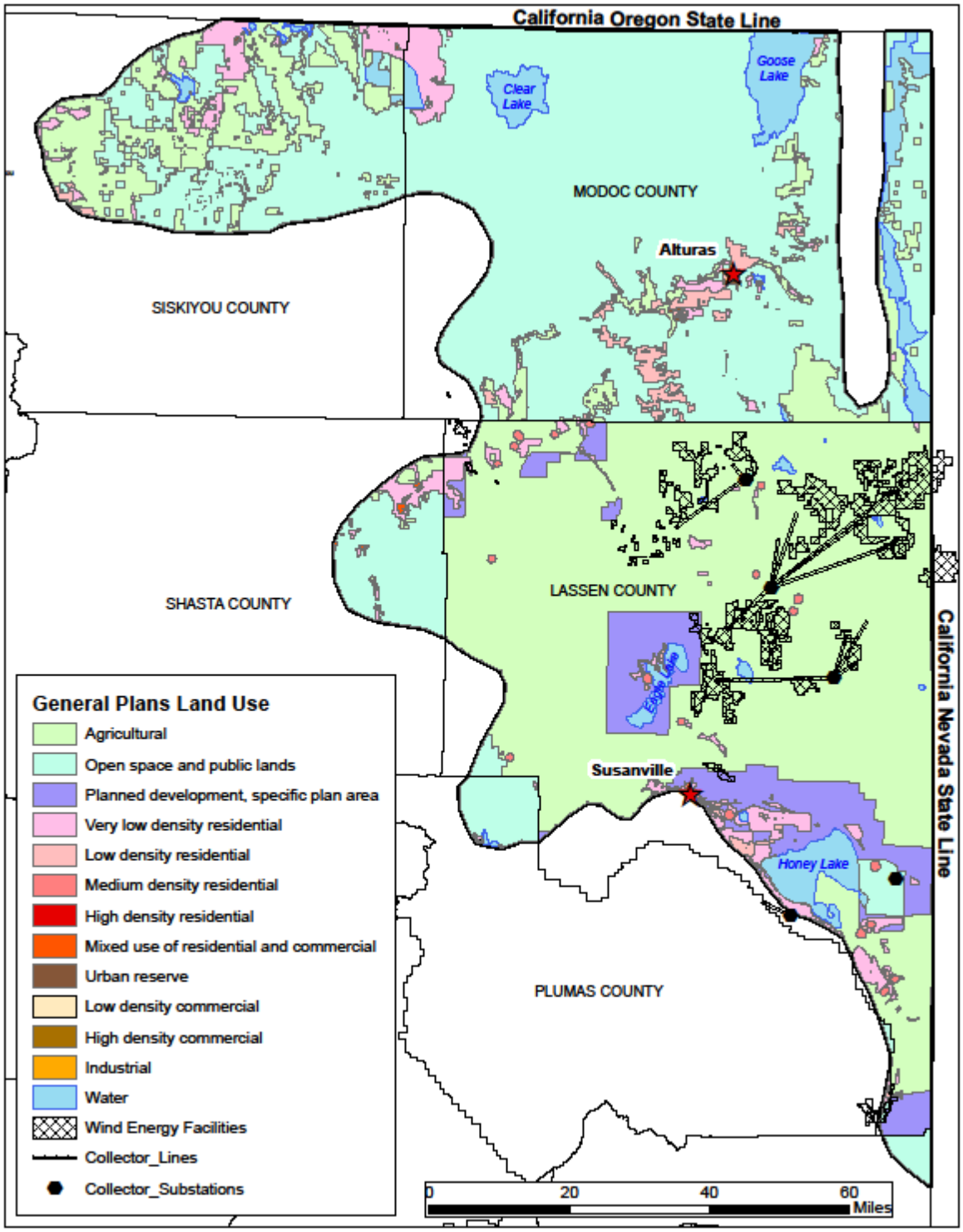

Figure 11. Land Use Planning within Pronghorn Antelope Range. Data Sources: General Plans with Rural Residential, California Resources Agency, UC Davis, 2004; Renewable Energy – Verified Project Applications (BLM), 2008.

range in northeastern California, and current and planned wind energy developments are shown in Figure 11. Federal land management agencies such as the USFS and the BLM regulate energy development activities on their lands, consequently areas generally safe from other types of development are now at risk from renewable energy projects.

Little research has been conducted on the environmental consequences and impacts of wind energy development to pronghorn antelope. It is expected that the construction and installation of the wind turbines, like other forms of development, will displace pronghorn antelope. However the long-term impacts of wind energy production are uncertain. Surface disturbance from turbines and roads represent a small fraction of the total area impacted by wind energy development as large projects may cover tens of thousands of acres. Displacement and/or disruption of normal pronghorn antelope activities may occur on the entire project area, while other indirect effects could result in decreased survival. Transmission corridors that link to electrical grids have the potential to cause additional habitat fragmentation, while associated roads can further impacts of direct mortality and spread of non-native invasive plant species. These are some of the potential effects of wind energy development as described by Lutz et al. (2011) for mule deer.

Summary of Impacts to Habitat

The most important issue affecting the survival of pronghorn antelope is the availability of high quality habitats. A year round source of forage containing sufficient nutrients is needed to sustain a population, and for reproduction. Cover habitat is important all year but is most critical for fawn concealment and providing shelter from inclement weather. Pronghorn antelope rely heavily on sagebrush dominated habitats for both forage and cover, and loss of sagebrush and bitterbrush species is usually detrimental to herd health. Changes in the sagebrush habitats of the northeastern California pronghorn antelope range have been occurring over time, altering the ability of the landscape to support these animals and other wildlife species.

Native sagebrush habitats are being converted to other vegetative communities such as grassland, juniper woodlands, and agriculture. Causes of these conversions include natural succession, fire, and changes in land use. Bitterbrush found on pronghorn antelope range is typically past its prime as a forage plant, with little regeneration taking place. Juniper is spreading into sagebrush habitats as succession advances without being checked by fire or other human intervention. Fire destroys shrubs in sagebrush communities and sets the stage for cheatgrass and other grasses to take over. Human encroachment is taking an additional toll by loss of habitat to development, as well as indirect impacts. Disturbance in nearby habitats often results in avoidance behavior by wildlife because of human presence, roads, fences, and dogs.

Livestock grazing and wild horse and burro competition often decrease habitat quality, especially in habitats near water (riparian, springs, wetlands, etc.) and in drought years. Livestock use on Federal land is substantial, and wild equines are typically overstocked where they occur. This results in direct and indirect competition with these species and a decrease in habitat quality and availability for pronghorn antelope.

Decades of habitat alteration have resulted in vegetation communities that are less suitable for healthy pronghorn antelope herds. The future of pronghorn antelope in northeastern California will in large part depend on how public land managers and private property owners respond to these changes.

III. California Pronghorn Antelope Translocations

In 1982 California pronghorn antelope were only found in northeastern California and Mono County. All other populations established since that time are the result of animals relocated from the northeastern part of the state to various locations throughout California. These translocations were spurred by high pronghorn antelope population levels causing depredation problems on alfalfa fields and other agricultural crops, and a desire to re-establish pronghorn antelope in different locations (O'Gara et al. 2004). Table 8 summarizes translocation efforts from 1947 to 1990. The following text describes the translocation history, population status, and trend of each of the existing pronghorn antelope populations in California.

Description of Herds by County

Mono County

A number of translocations with release sites in Mono County were conducted during two time periods, 1947-50 and 1982-85. In 1947 pronghorn antelope relocations began with a release of 32 animals just north of Mono Lake. During 1949-50 the Adobe Valley area received an additional 113 animals. No more translocations occurred until 1982 when 53 pronghorn antelope were released in Adobe Valley. In 1984 an additional 25 animals were released in Adobe Valley, and then in 1985 a final group of 50 animals were released at an undisclosed location in Mono County (Pyshora 1977, 1986, Thayer 1984, 1985, CDFG files). A total of 145 animals were translocated during 1947-50, and an additional 128 were released during 1982-85 for a grand total of 273 pronghorn antelope translocated to Mono County.

PRONGHORN ANTELOPE CAPTURES AND RELEASES 1947 - 1990													
CAPTURE						RELEASE							
DATE	COUNTY	LOCATION	# CAPTURED	MORTALITY	NOTES	DATE	COUNTY	LOCATION	# RELEASED	BUCK	DOE	MORTALITY	NOTES
1947	Lassen	Mud Flat	32			1947	Mono	Just north of Mono Lake	32				Source: Pyshora, 1977
1949-50	Lassen	Mud Flat	113			1949-50	Mono	Adobe Valley	113				Source: Pyshora, 1977
September, 1977	Modoc	Goose Lake Valley Ranch	75	1 euthanized due to broken leg in trap	Alfalfa depredation 4 went to San Diego Zoo	September, 1977	Lassen	Eastern Lassen County	68			2 died en route to release site, 1 died after release	Source: Outdoor CA, Nov/Dec 1977
March 24, 1982	Siskiyou	Butte Valley	88				Lassen, Mono	Lassen, Skedaddle Mountains	29				
								Mono, Adobe Valley	53			6 died before release at the Mono site	Source: Interstate Antelope Conference 1982 Transactions
February 23, 1984	Modoc	Likely Tables	25				Mono	Adobe Valley	25	5	20		Source: Interstate Antelope Conference 1983 Transactions
February 21, 1985	Modoc	Big Valley	150 (approximately)	1 doe mortality at the trap site	Alfalfa depredation. 40 animals were released at the trap site, and 9 animals were sent to Mexico		Mono, Kern/LA	Mono County	50	8	42	One doe mortality at Mono release site	Source: Interstate Antelope Conference 1984 Transactions, 1986 Proceedings of the 12th Annual Pronghorn Antelope Workshop
								Kern/LA, Tejon Ranch	51	17	34	Two doe mortalities at the Tejon release site	
February 25, 1987	Modoc	Big Valley	124	5	Crop depredation.	February 26, 1987	San Luis Obispo	Camatta Ranch	39	11	27	One buck mortality at the Camatta release site	
							San Luis Obispo	Chimineas Ranch	39	7	32		Source: Interstate Antelope Conference 1986 Transactions, DFG files
							Kern	Tejon Ranch	40	3	37		
February 2 & 3, 1988	Modoc	Horse Mountain	269	4 due to trapping injuries		February 2 & 3, 1988	San Luis Obispo	Carrizo Plain N	49	15	34	4 mortalities during transport to the release sites.	Source: Interstate Antelope Conference 1987 Transactions, DFG files
								Carrizo Plain S	57	18	39		
								Camatta Ranch	54	14	40		
								Chimineas Ranch	58	9	49		
							San Benito	Bailey Ranch	43	11	32		
February 14 & 15, 1990	Modoc	Likely Tables	288	2 escapes and 5 mortalities at trap site			Monterey	Scobey Ranch	50				Source: Interstate Antelope Conference 1989 Transactions, DFG files
								Camp 5	60			1 mortality during transport to release site	
							Colusa	Slobe/Anderson	51			2 mortalities during transport to release site	
							Santa Clara	Hewlett Packard	50				
							San Benito	San Benito	33			2 mortalities during transport to release site	
							San Luis Obispo	Carrizo Plains	37				

Table 8. CDFG Pronghorn Antelope Translocations 1947 - 1990

This interstate population of pronghorn antelope winters in Nevada and summers in the Bodie Hills of California where fawning also takes place. Tim Taylor, CDFG Environmental Scientist in Mono County, reports that occasionally there are anecdotal reports of pronghorn antelope in Adobe Valley, east of Mono Lake, but those are probably part of the Bodie Hills population. A small herd that occupied Hammil and Benton Valleys at the base of the White Mountains is presumed extirpated. The Nevada Department of Wildlife (NDOW) manages the Mono County herd, and conducts population monitoring (T. Taylor, CDFG, personal communication). The NDOW population estimate for this herd is approximately 150 pronghorn antelope (Cox et al. 2012). The herd is considered to be experiencing a stable population trend despite ongoing poor vegetation conditions related to continuous drought. NDOW has a limited hunting season when the numbers allow, which resulted in 7 pronghorn antelope buck tags being issued in 2010 (Cox et al. 2011).

Glenn/Colusa County

A group of approximately 40 pronghorn antelope currently occupy Glenn County, generally in the area west of the Willows airport and south of Hwy 162. The origin of these animals was a translocation that occurred in February of 1990. Animals were captured in the Likely Tables area of Modoc County to be distributed to several release locations. Of these, 49 were released on the Spring Valley Ranch in Colusa County, west of Williams in the area of Cortina Ridge. According to Paul Hofmann, CDFG Environmental Scientist, about 9 of these pronghorn antelope managed to get across the Tehama-Colusa Canal (probably went through the Spring Valley Siphon) and started heading north. These finally stayed in the area west of the Willows airport in Glenn County and multiplied to a group of about 40. Over the years small groups were common around Norman Princeton Road, just west of I-5. Other small groups have been seen on Sacramento NWR and in the Williams/Arbuckle/ 505 area. These small bunches have disappeared as time passed, and none have been on the ranch where they were released for over a decade. The existing population is "stable" at around 40 pronghorn antelope. The herd sometimes expands, but when the animals spread out they usually just disappear (P. Hofmann, CDFG, personal communication). One possible explanation for this herd's success is that the area is relatively fence-less and rice is grown in the area. It has been reported that they are often seen in the dry rice fields as well as in alfalfa and fallowed fields.

San Benito County

In February 1988, the Bailey Ranch in southern San Benito County received 43 pronghorn antelope during relocation efforts, and two years later 33 more were released in San Benito County, to a location not specified (Pyshora 1988, Thayer 1990, DFG files). Jeff Cann, the current CDFG wildlife unit manager for San Benito County, sees a very few pronghorn antelope (1-3) periodically east of King City just north of where Bitterwater Road meets Highway 25. There is a large bend to the east on Hwy 25 and pronghorn antelope are seen in fall in the pasture on the north side of the highway. In 2000 about 20 pronghorn antelope

were seen during an aerial deer survey on the Topo Ranch near the area just described, but they have not been seen in that area since. It is likely that they are barely hanging on there. Possible reasons for the decline is a combination of fence problems and the fact that barley and alfalfa are becoming less lucrative crops for local farmers due to lack of rain and available ground water (J. Cann, CDFG, personal communication).

Monterey County

A February 1990 translocation from Likely Tables, Modoc County resulted in 50 pronghorn antelope released on the Scobey Ranch (near Cholame Valley), and 59 released at Camp 5 (Thayer 1990, DFG files). Both release sites are located in the extreme southeast corner of Monterey County. The current group that resides in the Parkfield and Cholame Valley areas of Monterey and San Luis Obispo Counties are most likely the descendents of those releases. The Jack Ranch in Parkfield has year round irrigated alfalfa fields that are used by pronghorn antelope. This population was holding stable at 50-60 animals, however it appears to have declined recently and only 26 animals were seen in 2011 (B. Stafford, CDFG, personal communication).

Santa Clara County

A single release of 50 animals in February of 1990 occurred on the Hewlett Packard Ranch in Santa Clara County (Thayer 1990, DFG files). This property is also known as the San Felipe Ranch. Some of these animals moved to the Isabel Valley Ranch where there is now a remnant herd consisting of 3 animals; 2 does and 1 buck. However, fawn recruitment for the past several years has been nonexistent (C. Jones, CDFG, personal communication).

Alameda County

There may have been a number of pronghorn antelope from the Isabel Valley population in Santa Clara County that moved north into the Lake Del Valle area of Alameda County. There were reports in 2002-2004 of a herd of approximately 13 animals seen in the area, however there have been no recent reported sightings (Henry Coletto, Cañada de los Osos Ecological Reserve, personal communication). These pronghorn antelope are most likely remnants from the 1990 release in Santa Clara County (C. Jones, personal communication).

Kern and Los Angeles Counties (Tejon Ranch)

In February 1985, the Tejon Ranch received a group of 51 animals, and another 40 animals were released in 1987 (Pyshora 1986). Population surveys conducted by the Tejon Ranch indicate that the population is stable, with an estimate of approximately 40 animals counted annually (CDFG files). While the number of pronghorn antelope on the Tejon Ranch is not large, the Tejon Ranch Private Lands Management Program (PLM) Management Plan states that composition counts show a surplus of bucks beyond that needed for reproduction. Under the terms in the Tejon Ranch PLM agreement, they have been allowed to harvest 2 buck pronghorn antelope annually. Ongoing efforts to increase the pronghorn

antelope population include a focused predator control program in areas most used by pronghorn, cattle grazing management strategies, and maintenance of an irrigated food plot (CDFG files).

Kern County

A second small population of 10-15 animals in Kern County most likely splintered off the herds in the Carrizo Plain. This group was last seen in 2010 in the Little Santa Maria Valley, east of the Temblor Mountain Range along Hwy 58 in the San Joaquin Valley (B. Stafford, personal communication).

San Luis Obispo County

The most ambitious of the translocation efforts has been in San Luis Obispo County. A series of releases began with 39 animals on the Camatta Ranch and another 39 on the Chimineas Ranch in 1987. This was followed in 1988 with releases of 49 animals on Carrizo Plain North, 57 on Carrizo Plain South, 54 on the Camatta Ranch, and 58 on the Chimineas Ranch. The final release of 37 pronghorn antelope to the Carrizo Plains occurred in 1990, for a total of 333 animals translocated to San Luis Obispo County (Pyshora 1987, 1988, Thayer 1990, DFG files).

There are currently four distinct groups of pronghorn antelope in San Luis Obispo County, each named according to their location; California Valley, Carrizo Plain National Monument (CPNM), Cholame (includes Parkfield in Monterey County), and Camatta, located southwest of Shandon. These are separate populations that do not mix with each other. The Camatta group is the smallest, as numbers have declined to only about 5-10 animals. The current population estimate for the California Valley herd is approximately 50 however construction of two solar plants is in progress within this herds range. These developments are expected to impact this herd, although to what extent is unknown. The group on the CPNM has been declining since at least 2009, and as of 2012 is estimated at 20-30 animals. The Cholame Valley (including Parkfield in Monterey County) population was considered stable at approximately 50-60 animals but as of 2011 only about half that number has been seen (B. Stafford, personal communication).

The populations described here are all that are known by the author and the CDFG wildlife unit managers at this time. It is possible that there are additional unreported small populations, particularly in the central coast area.

Carrizo Plain and California Valley Herds

The Carrizo Plain is located on the southwestern edge of California's Central Valley, and is home to two of the pronghorn antelope herds of San Luis Obispo County. The California Valley herd inhabits mostly private property in the California Valley area and north (excluding the Cholame and Camatta herds), and the CPNM herd resides to the south of California Valley. The CPNM group

occupies the mainly publicly owned land of the Carrizo Plains National Monument, and is the most studied of the herds.

The San Joaquin Valley supported one of the highest densities of pronghorn antelope in the country before the gold rush of 1849 (Pyshora 1977, Yoakum 2004a). Numbers quickly declined in the mid to late 1800's due to unregulated hunting, livestock competition, agriculture, and changes in land use (CDFG 1989). Pronghorn antelope were completely eliminated from the Carrizo Plain by the 1930's (Yoakum 2004a). While the Carrizo Plain remains relatively undisturbed by development, vegetation changes to the original habitat caused primarily by extensive livestock grazing and conversion to agriculture during the 20th century have reduced the ability of the habitat to support the numbers of animals of the past (Yoakum, 2004c). In an effort to reestablish pronghorn antelope to the Carrizo Plain, CDFG transplanted a total of 240 animals from northeastern California in 1987, 1988, and 1990. The two pronghorn antelope herds (California Valley and CPNM) currently residing on the Carrizo Plain are the descendants of these transplanted animals.

The Carrizo Plain includes the largest surviving remnant of habitats of the San Joaquin Valley as they generally appeared before changes caused by agriculture and other human development. The preservation of this area is extremely important to several sensitive species; the San Joaquin kit fox (federally endangered, state threatened), the blunt-nosed leopard lizard (endangered on state and federal lists), the San Joaquin antelope squirrel (listed as threatened in California) and the giant kangaroo rat (endangered on state and federal lists). To help protect this area and its habitats, the Carrizo Plain National Monument was established in 2001. The monument encompasses 250,000 acres that is co-managed by the BLM, CDFG, and The Nature Conservancy (BLM 2011b, Sisk et al. 2008). This area is home to the CPNM pronghorn antelope herd.

Food habits of the Carrizo Plain pronghorn antelope differ substantially from the herds in northeastern California both in species and structure. Grassland is the primary habitat type used by pronghorn antelope in the Carrizo Plain. In a few areas brush is available, and of these *Atriplex* spp. is favored. However available water is a limiting factor in some areas of the Carrizo Plain and these shrubs are not always accessible due to lack of water. In the absence of livestock, BLM sporadically maintains artificial water sources on their lands (B. Stafford, personal communication). Livestock generally do not compete with pronghorn antelope for forage, however livestock have been known to keep pronghorn antelope from coming in to water. Competition with elk is also not considered to be a problem. Studies have shown that pronghorn antelope and elk coexist without competing, as their diets differ in that elk focus on grasses while pronghorn antelope prefer forbs. In the Carrizo Plain elk and pronghorn antelope are sometimes seen grazing together (Yoakum 2004c).

The most critical time of year for pronghorn antelope in the Carrizo Plain is September and October, when conditions are driest and forage is in poor

condition. In the California Valley area often the only vegetation growing at that time of year is bindweed, *Convolvulus arvensis*, which may be what sustains the California Valley pronghorn antelope herd through the season in some years. Seasonality of available habitat contributes to mortality of pronghorn antelope because of the erratic boom to bust fluctuations that occur in the Carrizo Plain (B Stafford, personal communication). Drought is common in the Carrizo Plain. In fact, drought conditions necessitated supplemental feeding of alfalfa to pronghorn antelope on CPNM during 2002 (Koch and Yoakum 2002).

Rainfall in the Carrizo Plain ranges from 9-10 inches in the north to 4-5 inches in the south end of the valley. The CPNM is located in the drier end of this gradient. The northwest corner of the CPNM is managed for pronghorn antelope habitat and is not grazed unless it exceeds 15 inches in height. This management results in the best pronghorn antelope habitat on the monument, however limited water may be an issue due to the BLMs practice of not consistently maintaining water where no livestock grazing occurs. Decreased water availability may be a factor in the CPNM pronghorn antelope herd population decline (B. Stafford, personal communication).

Currently there are two solar energy plants being constructed within the range of the California Valley pronghorn antelope herd. These developments will result in loss of habitats that have been used by this herd, and to mitigate the losses habitat work will be performed on nearby areas. Most mitigation work will focus on habitats for kit fox, emphasizing low cover. Pronghorn antelope generally will not benefit from these low profile habitats, however it is anticipated that some mitigation areas will be available for pronghorn antelope specific habitat projects. Work for pronghorn antelope is expected to focus on increasing shrubs (*Atriplex* spp.) and forbs for summer forage. Vernal pools that have previously been plowed every year may be restored, supplying forage that would typically last through June (B. Stafford, personal communication).

A great deal has been learned about the habitats of the Carrizo Plain since the reintroduction of pronghorn antelope took place, both for pronghorn antelope and the sensitive species they share their range with. Land use in the Carrizo Plain, including the CPNM, has changed. Much of the pronghorn antelope habitat was under cultivation when the translocated animals were released. Now most of those same areas are fallow fields and would benefit from habitat enhancement projects. Other parts of the Carrizo Plain have potential for habitat work as well. Many studies as well as trial and error management have played a part in gathering information to better understand the relationships of the various wildlife species to each other and to the habitats of the Carrizo Plain. The CPNM in particular has been the focus of several important studies, which are summarized in the following section. Detailed mapping of the vegetation of the CPNM has been completed, and vegetation mapping of the balance of the Carrizo Plain is anticipated to be accomplished soon (B. Stafford, personal communication).

Studies on pronghorn antelope in the Carrizo Plain

Habitat Suitability and Food Habits of Pronghorn Antelope in the Carrizo Plains National Monument, California

Longshore and Lowrey (2008) conducted a study on habitat suitability and food habits of the pronghorn antelope within the CPNM. This study was designed to investigate possible causes of the pronghorn antelope population decline on the CPNM, with an emphasis on habitat quality and pronghorn antelope food preferences. To accomplish the study objectives, a variety of data were collected in 2003-2004 and analyzed by various methods. These included habitat suitability criteria, diversity indices of vegetation, diet composition, nutritional quality, and water source locations.

The study found that consumption of the different forage classes fluctuated throughout the year, but forbs were consistently utilized in the greatest proportions. Grass was eaten most in the spring, with decreasing amounts used in the summer. Seeds, nuts, and berries were eaten in the summer, fall, and winter, and shrub use was most pronounced in the fall. Results also showed that toxic plants such as *Salsola* spp. and *Astragalus* spp. were consumed, however it was unclear whether the amounts eaten during the study were enough to negatively affect these pronghorn antelope.

Analysis of habitat suitability resulted in ranking the CPNM moderate to low for pronghorn antelope. While low slope values preferred by pronghorn antelope occurred in sufficient areas, only a handful of pastures appeared to supply adequate fawn concealment habitat (appropriate vegetation height) and long range visibility. The ability to remain hidden is essential to pronghorn antelope fawns as it is their only defense against predators, and adult pronghorn antelope must be able to see long distances to escape from threats. It was speculated that the relatively small area that contained fawn bedding areas may result in higher levels of predation on the CPNM. Habitat quality in regards to shrub cover and diversity also appeared to be limited for pronghorn antelope on the CPNM.

The study concluded that conditions within the CPNM may not be adequate to sustain a viable population of pronghorn antelope. Habitat enhancements were recommended to increase vegetative cover and plant species diversity. Specific recommendations included seeding with perennial grass to provide cover for fawns, and seeding with species that would increase forage diversity for pronghorn antelope, especially in the summer and fall.

Survival of pronghorn fawns on the Carrizo Plain National Monument: relationships between predation, birth synchrony, and habitat

Johnson et al. (2010, 2011) conducted a study to identify factors affecting pronghorn antelope fawn survival on the CPNM. The primary objectives of the study included quantifying fawn survival and examining the relationship of predation, habitat use, and birth synchrony on fawn survival. The final analysis and report has not been completed yet, however the 2010 Draft Annual Report and the 2011 Data Summary describe preliminary findings.

20 pronghorn antelope fawns were captured and fitted with lightweight GPS collars. Fawn mortality was found to be high, with predation by an unspecified mammal being the main cause of death. Fawning sites in 2010 occurred in open, flat grassland habitat near areas of saltbrush scrub. Diet analysis from pronghorn antelope fecal samples collected in 2008 and 2009 indicated that forbs were consumed in the highest quantities all year, with grasses and shrubs used at much lower levels, except in January when grasses formed approximately 1/3 of the diet. A variety of plant species made up the diet, however *Erodium spp.* was shown to be most commonly eaten.

Further data analysis will be forthcoming in a final report of the study.

Habitat Connectivity Planning for Selected Focal Species in the Carrizo Plain

This study was conducted by Penrod et al. (2010) in an effort to describe movements and habitat use of wildlife on the Carrizo Plain. The study was in response to proposed solar energy developments and the potential impacts to specific species of wildlife. The three species investigated were tule elk, pronghorn antelope, and San Joaquin kit fox. The primary goal of this study was to determine the potential impacts of the solar projects on the probable movements and genetic flow of the focus species between the Carrizo Plain, Cholame Valley, and San Joaquin Valley.

Footprints of the two proposed solar energy projects occurred within areas identified by the study as highly suitable habitat and highly permeable to pronghorn antelope movements. Permeability in this study refers to how freely animals can move through a landscape. These projects as proposed would nearly bisect the Carrizo Plain into north and south sections, likely resulting in impacts to both habitat and connectivity for all three species investigated. Foraging, reproduction, seasonal movements, and dispersal are expected to be impacted.

The Topaz solar project was proposed to be located within the range of the California Valley pronghorn antelope herd, mainly within highly suitable habitat. The study stated that implementation of the Topaz project may result in a substantial reduction in available habitat and displacement of the herd. The Topaz project has since been approved with little change to the original footprint, and is currently under construction.

Discussion of translocation efforts

The translocation efforts of the 1980s and 1990 can be considered a good starting point to restore pronghorn antelope to different areas in California. The relocations resulted in a number of new herds occupying counties where they had not occurred in decades. These animals were left to adapt to their new environments, and some moved to find habitats more to their liking away from their release sites. Given the fact that little research was done on the suitability of release sites, it is a positive sign that these animals still persist. We now have the benefit of over 20 years of observation of these pronghorn antelope herds to learn from.

Most of the herds resulting from the relocations have declined over time, and some are about to disappear altogether. In some instances habitat conditions may not meet the requirements of supporting a pronghorn antelope herd. Other herds could have declined because of transitory conditions such as drought or land use that has now changed for the better. Another factor that could be impacting the smaller herds is an Allee effect, which is the theory that in very small populations, the reproduction and survival rates of individuals increases with population density. As populations decline, mortality increases, preventing positive population growth. Certain pronghorn antelope herds in California are at a critical point where augmenting with additional animals might be the only way to keep their populations from vanishing.

There are many factors that may have contributed to the low survival and recruitment of these translocated pronghorn antelope herds. Each herd is unique, and conditions must be assessed for individual populations. However there are several common themes found in the literature regarding translocation success. Likely causes of translocation failure include inadequate forage and/or cover habitat at the release sites, differences in habitat between capture and release sites, drought conditions since the translocation, too few animals released, and lack of suitable area large enough to support a viable population of pronghorn antelope.

Habitat quality is especially important to establishing new herds from animals brought in from different areas. Information on translocations in the 2006 Pronghorn Management Guides state that “relocated herds that increase 20-30% within 5-10 years after release are indicative of herds that are responding to suitable habitat conditions” (Autenrieth et al. 2006). High quality habitat at the

release site is essential for the survival of translocated animals. In addition, the habitat should be similar to where the animals originated to give them their best chance at establishing themselves (Griffith et al. 1989, O'Gara et al. 2004). The habitats of release sites in central California differed from those in northeastern California where these pronghorn antelope originated. These animals came from sagebrush scrub habitats and were often accustomed to foraging on crops; they were then moved to grassland dominated areas. However, the translocated pronghorn antelope have managed to survive through the past 20+ years, demonstrating an ability to adapt to new habitats.

The number of animals released and the amount of area available to be occupied may have been less than what was needed for many of the California translocations. Hoover et al. (1959) developed criteria for the selection of translocation sites for grasslands in Colorado. The recommendations are still considered valid, including for pronghorn antelope range outside of Colorado. They state that each animal requires at least 1 square mile of suitable habitat, with a minimum of 100 animals per site (Autenrieth et al. 2006). Many of the areas in California that were used as release sites received significantly fewer than 100 animals.

The survival of the remaining California pronghorn antelope herds established by translocation is in jeopardy. It appears that numbers within these populations are so low that predation and other factors may cause the disappearance of several herds. Augmentation with additional animals may help overcome issues of low herd numbers, however this approach will only be successful if sufficient habitat is available to support the increased population.

Recommendations for Future Translocations

The future of pronghorn antelope translocations in California will require an intensive investigation of prospective release areas. Suitable habitat that fits the needs of pronghorn antelope will be difficult to find, however a system of rating habitat characteristics can be used to identify appropriate sites.

Habitat suitability was used as the main criterion for evaluating five potential shrub-steppe translocation sites in Mono County, California (McCarthy and Yoakum 1984). Procedures for choosing the best five sites included an evaluation of these 9 criteria:

1) Habitat suitability (water and vegetation)
2) Mean winter snow depths
3) Major physical barriers such as large ravines, mountain ranges, dense shrubs, or timbered areas
4) Potential size of release site (optimum area size was considered > 100 square miles)
5) Livestock fences in relation to pronghorn passability
6) Potential for predation on pronghorn
7) Potential for agricultural crop depredations

8) Seasonal suitability, based on food availability and whether or not an area could support pronghorn on a year-round basis
9) Potential for forage competition with livestock

These criteria continue to be pertinent and valuable to suitability studies. Similar strategies for evaluating sites should be used in assessing potential release sites, and to provide insight into the feasibility of a transplant of pronghorn antelope.

Supplementing Existing Populations

The following represents the observations of the author regarding the factors that may affect the potential for supplementing existing California populations with additional pronghorn antelope to boost their chances for survival. These conclusions are based on limited information, and the local biologists should be considered the authority on each herd and its habitat condition. If an addition of animals is proposed for any of these herds, a habitat suitability study similar to that described in the previous section is highly recommended.

The Glenn County population has grown in the past, however small groups would break off and move to other areas only to decline and die out. It is possible that there is not enough continuous suitable habitat to maintain a larger herd. The addition of more animals could also cause depredation problems in the farmed fields.

In Alameda, Santa Clara, and San Benito Counties the current pronghorn antelope populations are extremely low, so that a full repopulation would be necessary. Considering the growth and human encroachment that has occurred in these counties, it is unlikely that areas exist with enough continuous suitable habitat to maintain a viable population. In addition, San Benito County agricultural practices have changed in some places to crops incompatible with pronghorn antelope habits.

The Cholame herd in Monterey and San Luis Obispo Counties consistently uses alfalfa fields in the Parkfield area, and may depend on them for survival. An addition of more animals has the potential to cause depredation problems.

The San Luis Obispo County herds include the California Valley herd, CPNM herd, and the Camatta herd. The California Valley herd is currently being impacted by the construction of two solar power plants placed within some of this herd's best habitat. Where the animals of this herd will be displaced to and what role mitigation will play is to be seen. The CPNM herd occupies land that is mostly publicly owned, however the existing habitat may be marginal to support a viable year-round pronghorn antelope population. There is potential for habitat improvements to increase habitat quality which may offer additional support for this herd. The Camatta herd is currently at very low numbers, so that a full

repopulation would be necessary. The reasons for the decline of this herd are unknown.

In Kern County a small population of pronghorn antelope has been seen along Hwy 58 in the San Joaquin Valley, not far from the Carrizo Plain. The habitat potential and feasibility for additional animals of the area is unknown.

The Tejon Ranch in Kern and Los Angeles Counties has maintained a small population of pronghorn antelope over the years. These animals use the Antelope Valley area to the east of Interstate Hwy 5. There are plans for an 11,700 acre housing development (Centennial Project) that will cover a portion of the west end of the Antelope Valley. Solar energy development is occurring nearby in Los Angeles County, and the Tejon Ranch will have an easement in the area that the pronghorn antelope currently use. There is little pronghorn antelope use south of highway 138, and the Tejon Ranch north of the aqueduct is considered the best possibility for survival of this herd (B. Stafford, personal communication).

The CDFG would like to have a self sustaining pronghorn antelope herd in central California. The most likely area for this to occur is in the Carrizo Plain, with the Tejon Ranch as a secondary site. It would be ideal if connectivity between the two areas is possible.

While the Mono County herd is also a smaller, isolated herd, it has a different history than the herds established by translocations in 1985 - 1990. The Mono County herd has existed for a much longer period of time, a result of early translocation efforts in 1947 and 1949-50. The population was supplemented with additional animals in 1984 and 1985 (Pyshora 1977). The population of this herd is relatively stable, and appears to be in no immediate danger of extinction. Funding has been approved for a collaring project designed to study seasonal movements and patterns. The results will help both California and Nevada in the management of this interstate pronghorn antelope herd (Cox et al. 2012).

IV. Summary

Aggressive translocation efforts were the answer to crop depredation problems when the 1982 Pronghorn Antelope Management Plan was written. The 1987 - 1990 relocations resulted in many new pronghorn antelope herds residing in different parts of the state, however the long term survival of many is now in question. The northeastern California herds did not rebound after the winter of 1992-93 when a third of the animals were lost, however overall the population has remained fairly stable for the past ten years.

The sagebrush habitats that pronghorn antelope of northeastern California depend on, particularly on winter ranges, have been changing for a number of years to lower quality habitats. Juniper encroachment is decreasing the amount

of open range with brush species that pronghorn antelope prefer. Sagebrush and bitterbrush are commonly becoming old and decadent where they have not been replaced by cheatgrass and other less favorable species. Cheatgrass often takes over after fire and out-competes native vegetation. The combination of these changes is diminishing high quality sagebrush habitats that pronghorn antelope need to thrive.

The majority of pronghorn antelope habitat in northeastern California occurs on federal lands managed by the USFS and the BLM. BLM land is generally preferred by pronghorn antelope for winter range and fawning/kidding grounds, however there are exceptions in some areas. BLM property management includes widespread livestock grazing and maintenance of wild horse and burro herds. These management practices generally result in negative impacts to pronghorn antelope forage and water availability, and low precipitation years often intensify these issues.

Human encroachment on privately owned land within the northeastern California pronghorn antelope range has been less than what often occurs in more densely populated parts of the state. In addition, private land makes up only about 38% of the range, resulting in less area where human activities displace pronghorn antelope. However, location and type of human activity is more important than size of area affected, and current threats to migration corridors are a significant threat to pronghorn antelope persistence. Private land within the range historically has been dominated by rural ranches or open space, but there has been a transition from undeveloped land to developments on parcels of 40+ acres. Human disturbance on private land is expected to increase in the future, and over time these changes will have a cumulative effect on pronghorn antelope habitat on private land. Management must take into account future growth and land use that will occur.

No modern research has been completed on pronghorn antelope in northeastern California, leaving them vulnerable to impacts from land planning and development of remote areas. Telemetry studies are badly needed to update and increase our knowledge regarding current migration routes and seasonal use areas.

A great deal of time, energy, and money was spent on the California pronghorn antelope translocations of 1987 – 1990. The result was at least 8 new herds spread from Glenn County south to Kern County. These new populations have managed to survive to some extent, although many have experienced a precipitous decrease in numbers. The Carrizo Plain herds have received the most attention in the form of studies and interest in land use and other possible impacts to the populations. The Department has been in a “watch and learn” mode, gaining important insight into these animals and the habitats they depend on. If we are to maintain any of the herds resulting from the translocations, now is the time to act. Supplementing these herds with additional animals may be the

only way to save them. However this approach should only be considered after evaluating current conditions to determine if there are adequate resources to support a herd of 100+ pronghorn antelope at each location.

As was true in the 1970's, the major factor restricting pronghorn antelope populations in California is the lack of suitable range (Pyshora 1977). New challenges facing pronghorn antelope include renewable energy development and climate change. Renewable energy directives are focusing on the exploration of wind and solar energy development on pronghorn antelope ranges. This new emphasis on renewable energy has the potential to impact pronghorn antelope and their habitats on both public and privately owned lands. Climate change may alter weather patterns and affect pronghorn antelope behavior. Either extreme winters or extended drought can result in decreased survival. Identification of areas used by pronghorn antelope on both public and private property will help to focus conservation efforts efficiently to support this species in California.

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