State of California
Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE

DRAFT

ELK CONSERVATION AND MANAGEMENT PLAN

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EXECUTIVE SUMMARY

California supports three of the four remaining North American elk (*Cervus canadensis*) subspecies. Prior to European arrival and settlement, it is estimated that more than 500,000 elk inhabited parts of the San Joaquin Valley and the Coast Range, and central, northern and northeastern parts of the state into Oregon. During this time, indigenous people managed and utilized elk for food and other purposes. Non-indigenous settlement decimated California's elk populations, especially tule elk (*C. c. nannodes*) which only inhabited California. By 1872, only a few tule elk remained in the San Joaquin Valley. Protective conservation measures, successful translocation efforts and natural dispersal of elk into suitable habitat have allowed for recovery in portions of their historical range and allowed expansion into areas previously unoccupied (e.g. Owens Valley). Elk population growth since 1970 has been significant; California now supports approximately 5,700 Roosevelt elk (*C. c. roosevelti*), 1,500 Rocky Mountain elk (*C. c. nelsoni*) and 5,700 tule elk.

While elk population growth and range expansion may continue in the near future, California most likely will never again support 500,000 elk because of residential and agricultural development and its business and transportation infrastructure. Conflicts between expanding elk and human populations are significant at some locales. Of particular importance are private property conflicts and public health or safety incidents. Section (§) 3952 of the Fish and Game Code (FGC) was adopted in 2003 against the backdrop of increasing conflicts between elk and human populations, and requires the Department of Fish and Wildlife (Department) to develop a statewide elk management plan that is consistent with California's wildlife policy.

The Department has jurisdiction over the conservation, protection, and management of elk and the habitat necessary to sustain them, FGC §1802. California's wildlife policy emphases three general goals: to maintain sufficient wildlife resources for their intrinsic values, to provide for diverse public uses and economic contribution to citizens, and to alleviate economic losses and public health/safety problems (FGC §1801). Based on FGC §3952, the statewide elk management plan must emphasize enhancing and maintaining sufficient populations of all three subspecies of elk in perpetuity, with specific consideration of the following:

- Characteristics and geographic range of each elk subspecies within the state, including Roosevelt elk, Rocky Mountain elk, and tule elk;
- Habitat conditions and trends within the state;
- Major factors affecting elk within the state, including, but not limited to, conflicts with other land uses;
- Management activities necessary to achieve the goals of the plan and to alleviate property damage;
- Identification of high priority areas for elk management;
- Methods for determining population viability and the minimum population level needed to sustain local herds; and

- Description of the necessary contents for individual herd management plans prepared for high priority areas.

The Department is also committed to establishing a positive, cooperative relationship with California federally recognized Tribes (Tribes) regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape. In order to achieve the goals regarding California's elk populations, innovative management actions and collaboration will be required, and guidance from a statewide elk management plan is necessary to help mediate competing and conflicting interests. This elk management plan is designed to address these goals and objectives and assure the maintenance, restoration, and enhancement of California elk populations and habitat.

Based on this framework and the requirements in FGC §3952, a nine person working group reviewed elk management plans from other states and Canadian provinces and provided initial recommendations to develop California's plan. The working group consisted of three members from the Department, two representatives from the Rocky Mountain Elk Foundation, and one each from the United States Forest Service, Bureau of Land Management, California Cattlemen's Association, and California Farm Bureau Federation. Whereas the working group provided initial recommendations, preparation of the management plan was the responsibility of the Department as the managing steward of California's wildlife resources. Beginning in 2016 the Department began working with Tribes for input to address Tribal concerns.

The statewide elk management plan describes historical and current geographic range, habitat conditions and trends, and major factors affecting Roosevelt, Rocky Mountain, and tule elk in California. It identifies, delimits and describes high priority areas for elk management, referred to as Elk Management Units (EMUs). The 22 EMUs collectively comprise the current known distribution of elk in California with a few exceptions. Documents specific to each EMU (see Appendix E) contain information for high priority areas under the following headings: Description of EMU, Elk Distribution and Abundance, Management Goals, Objectives and Actions, Herd Viability, Summary of Annual Harvests, and Unit Highlights. The working group's recommendations and the Department's experience with other species management plans inform the contents of the EMU documents. The statewide elk management plan considers methods of determining elk population viability.

Management activities to achieve plan goals generally emphasize maintaining and improving habitat conditions on public and private land. EMU documents identify specific management objectives and actions, along with who is responsible for those objectives and actions. Where it is (or may become) necessary to alleviate property damage and public health/safety problems within an EMU, regulated hunting is the recommended primary method of population control, followed by capture/translocation of surplus animals when regulated hunting is unfeasible or ineffective.

The Department recognizes the need to develop and maintain effective tribal/state governmental relations and to manage elk as a shared resource. The conservation,

management, protection, enhancement, and reestablishment of wildlife resources and habitat are critical to providing cultural, scientific, educational, recreational, aesthetic, and economic benefits for present and future generations of all Californians.

This management plan provides guidance and direction to help set priorities for elk management statewide. Whereas the management plan establishes general policies, goals and priorities on a statewide basis, individual EMU documents address issues specific to the unit and establish population objectives and future management direction.

Although the Department has statutory authority and primary responsibility for wildlife management in California, partnerships with other organizations and agencies have assisted with elk management in the past and will be increasingly important in the future. This plan emphasizes that sharing of resources and collaboration with all parties interested in elk and elk management will be essential to managing California's elk populations in the future.

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I. INTRODUCTION

As the trustee agency for the state's fish and wildlife resources, the California Department of Fish and Wildlife (Department) is responsible for the conservation, protection, and management of biologically sustainable populations of elk (*Cervus canadensis)* in California as identified in Section 1802 of the Fish and Game Code (FGC §1802). This management plan provides strategic guidance to manage Roosevelt elk (*C. c. roosevelti*), Rocky Mountain elk (*C. c. nelsoni*) and tule elk (*C. c. nannodes*) consistent with California's wildlife policy specified in FGC §1801. That policy emphasizes the following objectives: maintain sufficient wildlife resources for their intrinsic values, provide for diverse public uses and economic contribution to citizens, and alleviate economic losses and public health/safety problems.

Elk are California's largest land mammal and an important wildlife resource whose population growth in recent decades has been of great interest to the public. Elk also are popular with the hunting public, and from 2011-2015 the Department received an annual average of 33,054 tag applications for approximately 330 elk tags per year through the big game drawing. Elk currently inhabit approximately 25% (25,919,000 acres of public and private land) of California (Figure 1). At approximately 12,100 animals, the statewide elk population is growing (Figure 2).

California's human population (approximately 39 million) is larger than any other state in the country (U.S. Census Bureau 2012), which complicates wildlife conservation efforts and increases stressors (e.g., land development, urbanization, changes in land management practices, fire suppression, climate change, and invasive species) adversely impacting elk populations.

Because of increasing conflicts between elk and humans, legislation adopted in 2003 added §3952 to the FGC and required the Department to prepare a statewide elk management plan consistent with California's wildlife policy. Although a statewide tule elk management plan was written in 1979 and the Department has since prepared individual management plans for designated "high priority" tule elk herds, California lacked a comprehensive statewide plan to guide management of all its elk subspecies until addition of FGC §3952.

Based on state wildlife policy and the specific requirements in FGC §3952, a nine person working group reviewed elk management plans from other states and Canadian provinces and provided initial recommendations to develop California's elk management plan. The working group consisted of three members from the Department, two representatives from the Rocky Mountain Elk Foundation, and one each from the United States Department of Agriculture Forest Service (USFS), United States Department of Interior Bureau of Land Management (BLM), California Cattlemen's Association, and California Farm Bureau Federation. Preparation of the management plan became the responsibility of the Department as the managing steward of California's wildlife resources with recommendations from the working group. Beginning in 2016 the Department began working with Tribes for input to address Tribal concerns.

The statewide elk management plan describes historical and current geographic range, habitat conditions and trends, and major factors affecting elk in California. It identifies 22 high priority areas for elk management, referred to as Elk Management Units (EMUs; these are delimited and described in Appendix E). The EMUs collectively comprise the current known distribution of elk in California (however, elk are expanding their range and sightings periodically occur outside the EMU boundaries). Contents of the EMU documents came from the working group's recommendations and Department experience with other species management plans. EMU documents contain specific information for each high priority area, organized under the following headings: Description of EMU, Elk Distribution and Abundance, Management Goals, Objectives and Actions, Herd Viability, Summary of Annual Harvests, and Unit Highlights. The statewide management plan discusses methods of determining population viability.

The Department recognizes that some of its proposed activities and species management plans may adversely affect the interests of California federally recognized Tribes (Tribes). The Department is committed to consulting with Tribes on fish, wildlife, and plant issues, and assessing and avoiding to the extent possible adverse impacts of Department activities on tribal interests. The Department and Tribes share authority to regulate the take of elk as they move across the landscape and reservation boundaries. A Tribe maintains inherent power to regulate the take of elk by its members within its reservation. (NM v. Mescalero Apache Tribe (1983) 462 U.S. 324, 332, 335). Application of the FGC to a Tribe and its members within that Tribe's reservation is limited (FGC §12300). The Department may not enforce its elk regulations against tribal members within their Tribe's reservation when doing so is preempted by federal law or would infringe on the Tribe's right of self-government. Moreover, the Department is committed to providing Tribes with meaningful opportunities to participate in decision-making processes that affect tribal interests. It is important to acknowledge tribal interests and needs separately from public interests and needs. The Department and Tribes may share similar goals of enhancing elk populations as an integral part of the California's ecosystems, but have different management strategies. The loss or improper management of any natural resource may have repercussions for a Tribe that extends beyond the natural resource itself.

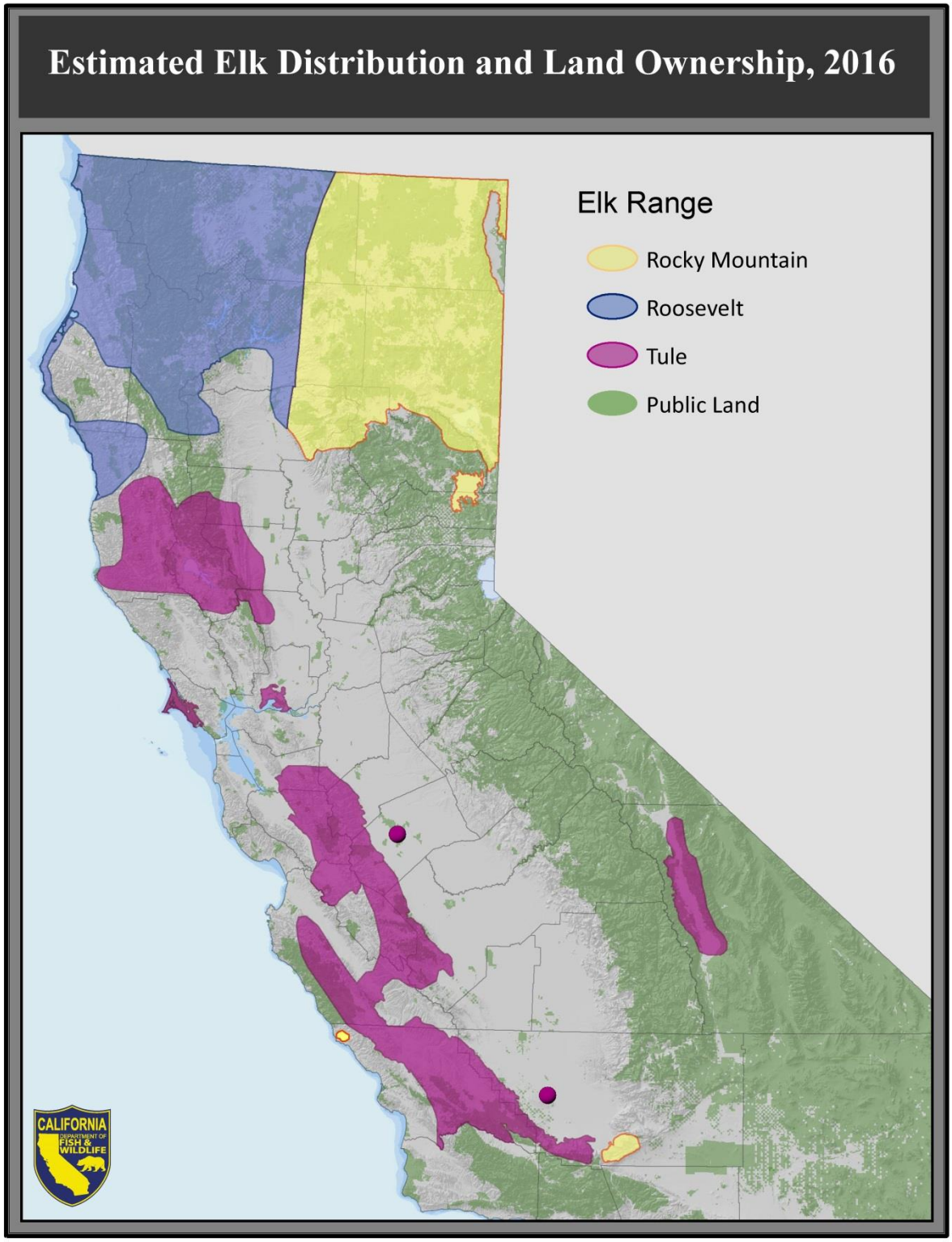

Figure 1. Approximate elk distribution in California on public and private land, 2016.

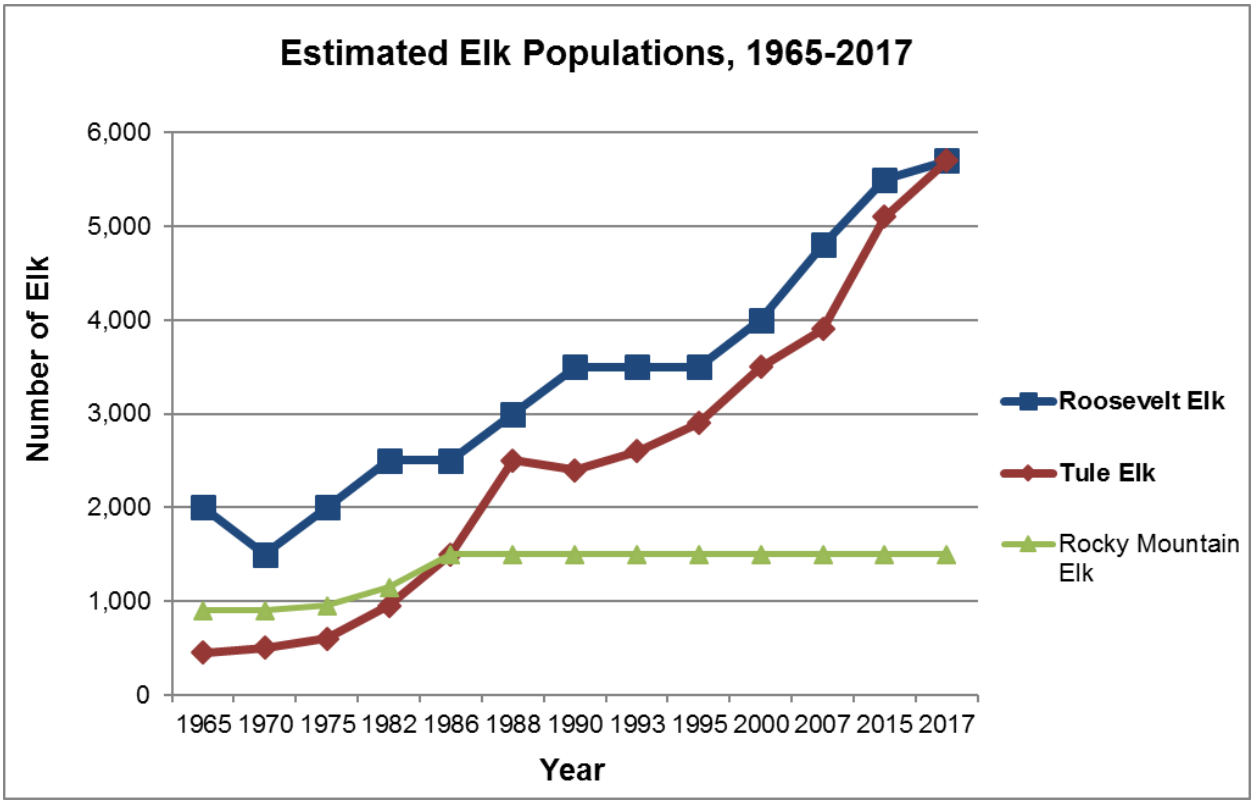

Figure 2. Estimated elk population numbers in California, 1965-2017.

A. Goals and Objectives

Effective conservation and management of elk requires reliable information on population demographics and the spatial/temporal use of habitats. This plan establishes a framework for an ongoing monitoring program to evaluate elk populations and habitat conditions. Determining population trends and the details of habitat use and distribution will help the Department understand how elk use available resources and interact with other wildlife species. The goals and objectives identified in this plan and its information gathering and monitoring provisions will help the Department maintain, restore, and enhance sustainable elk populations into the future. It will modernize strategies for recreational use, coordinate with governmental agencies, Tribes, and the public, and develop methods to alleviate resource conflicts.

A list of over-arching plan goals, including the objectives to achieve those goals, is summarized in Table 1, below.

Goals/Objectives		Complete by
Goal 1: Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.		
	Objective 1.1: Implement monitoring projects to estimate population abundance, distribution, habitat use, and demographics within each EMU.	2023
	Objective 1.2: Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal.	2028
	Objective 1.3: Improve the quality/quantity of elk habitats by at least 5%.	2028
	Objective 1.4: Determine the genetic diversity of elk populations and areas of hybridization, and identify populations that may benefit from translocations and habitat connectivity projects.	2023
	Objective 1.5: Monitor elk populations for disease and parasites to identify potential health concerns and areas requiring management actions.	On-going
Goal 2: Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape.		
	Objective 2.1: Develop co-management agreements, memoranda of agreement, or similar mechanisms with Tribes for the management of elk within each EMU.	2020
	Objective 2.2: The Department will work with Tribes to initiate at least five monitoring and/or habitat projects that will assist in guiding management decisions.	2025
Goal 3: Enhance opportunities for the public to use and enjoy elk (e.g. hunting and wildlife viewing).		
	Objective 3.1: Increase elk hunting opportunities by 10% where feasible and compatible with EMU population objectives.	2023
	Objective 3.2: The Department will work with other agencies and organizations to install 12 elk interpretative signs.	2023
	Objective 3.3: The Department will conduct four workshops to inform the public about elk and elk viewing opportunities.	2023
Goal 4: Alleviate human-elk conflicts and elk depredation complaints.		
	Objective 4.1: Reduce reports of human-elk conflicts on private property by at least 25%.	2023
	Objective 4.2: Identify and map areas of high human-elk conflict; assess potential for alleviating damage by reducing localized elk populations through regulated hunting, where feasible.	On-going

Table 1. Overall Elk Management Plan Goals and Objectives. (Confined Herds Unit has unique Goals and Individual EMUs may have additional objectives, see Table 2).

B. Taxonomy and Historical Distribution

California is unique in supporting three subspecies of elk; Roosevelt, Rocky Mountain, and tule elk. Historically, Roosevelt elk occupied the Cascade and North Coast mountain ranges extending south near San Francisco (Harper et al. 1967, Quayle and Brunt 2003), and eastward, at least to Mount Shasta (Murie 1951). Rocky Mountain elk

have inhabited portions of northeastern California for at least 100 years (McCullough 1969), and tule elk were distributed throughout the Central Valley and the grasslands and woodlands of central California's Coast Range (McCullough 1969). Figure 3 depicts historical range based on the best information available to Department researchers.

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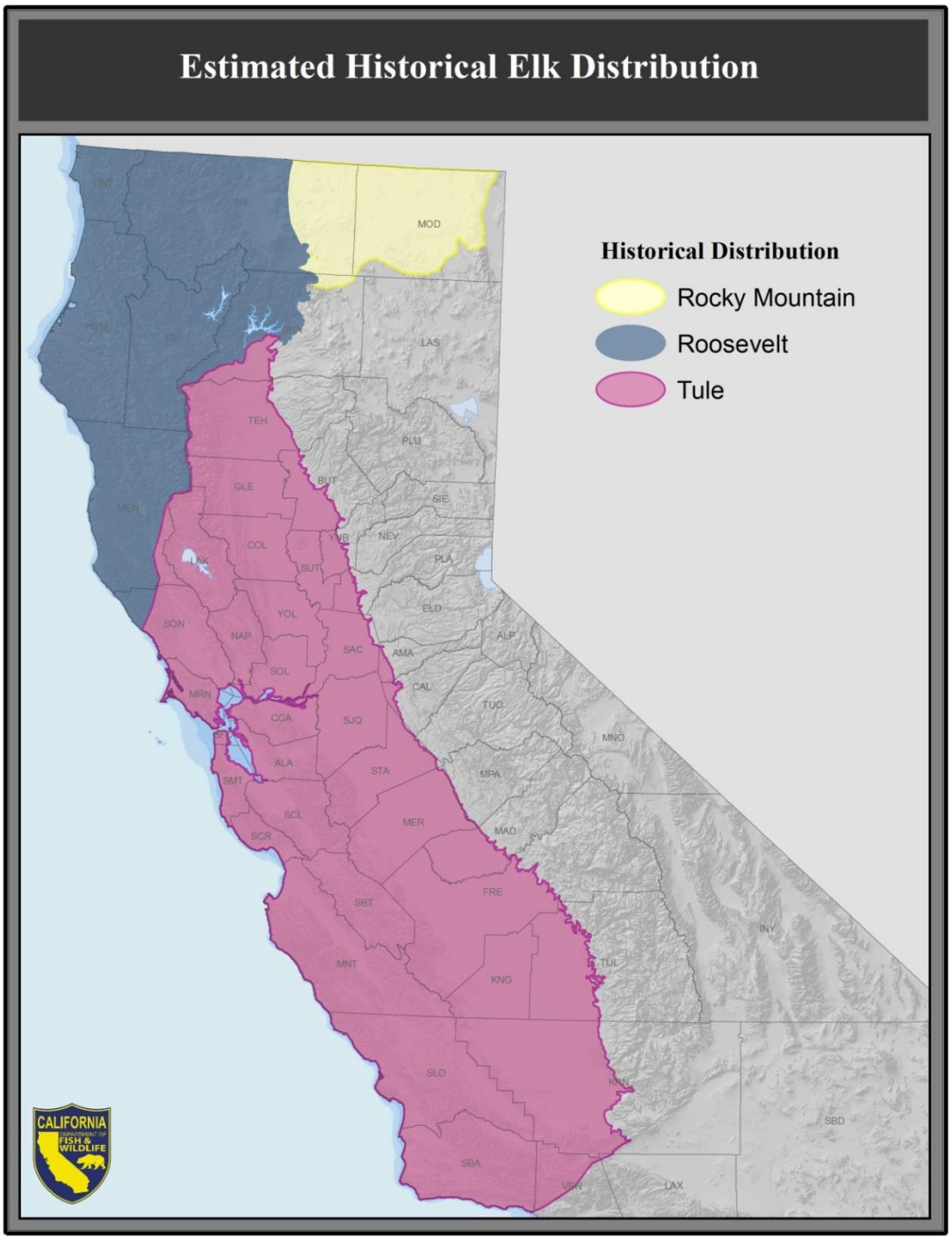

Figure 3. Estimated historical elk distribution in California according to Murie 1951, Harper et al. 1967, and McCullough 1969.

As elk populated North America during the Pleistocene epoch, they radiated into six distinct subspecies (Polziehn et al. 1998). Recovered specimens have helped scientists map the probable route taken by these highly mobile ungulates as they colonized western North America through northeastern California (Figure 4). Evolutionary forces

and isolation presumably gave rise to Roosevelt elk and California's tule elk subspecies (McCullough 1969).

The native status of the Rocky Mountain elk subspecies in California is a disputed topic, and their historical range is difficult to establish with certainty. Two museum specimens of skulls and antlers collected from northeastern California are similar to those of Rocky Mountain elk (McCullough 1969), suggesting that when Europeans arrived, this subspecies was present where conditions were favorable. However, Murie (1951) and Bryant and Maser (1982) speculated that the Great Basin and the Sierra Nevada and Cascade ranges served as a western barrier to the dispersal of Rocky Mountain elk. Murie cited historical accounts of elk in Nevada (Murie 1951), although densities were likely never great and their distributions disjunct. Thus, the Great Basin was not a complete barrier to Rocky Mountain elk and they occupied areas where habitats were most suitable. Because the historical presence of Rocky Mountain elk in California is poorly documented, the Department has in the past reported they were not native to California (Dasmann 1975, Curtis 1982, California Department of Fish and Game 1990).

Recent research indicates that Rocky Mountain and Roosevelt elk occupy the same range and interbreed in a portion of northeastern California (Meredith et al. 2007). However, genetic characteristics of present-day Rocky Mountain elk in this region have been confounded by translocations of this subspecies to northeastern California from Montana in the early 1900's. Murie (1951), Harper et al. (1967), and McCullough (1969) included portions of Shasta, Siskiyou and Modoc counties within historical elk range, however there appears to be disagreement regarding their subspecies classification. The presence of elk in northeastern California during the European expansion is substantiated in the writings of early American explorers and the ethnographic accounts of the Modoc and Pitt River Indians (Kniffen 1928, Bruff 1949, Ray 1963, Miller 1977). While the phylogenetic relationship of elk in the region remains an academic question, it is clear that elk were native and inhabited northeastern California when Europeans arrived.

C. Life History and Habitat

The elk is the second largest member of the deer family (Cervidae) in North America (Wisdom and Cook 2000). There is great variation in body size depending on the subspecies, geographic location, habitat, and nutrition (Geist 1998, O'Gara 2002, Peek 2003). Males, females, and young are referred to as bulls, cows, and calves, respectively. Elk form herds (groups) throughout much of the year (Peek 2003). Bull groups are not as cohesive as cow groups, with individuals departing and returning to the group over time (Franklin and Lieb 1979). Bulls generally segregate from cows and calves in late-spring through the summer antler growing period, rejoin cows and calves during early fall, and then form large combined groups in winter or early spring (de Vos et al. 1967, Bender and Haufler 1999, Peek 2003).

The rut, or breeding season, may begin as early as August and last into November. The rut for tule elk can continue later in the season in much warmer temperatures compared to other elk (Van Wormer 1969). After the rut, mature bulls can become reclusive or

form groups with other bulls (de Vos et al. 1967, McCullough 1969). In mid-May until early June, cows seek solitude for calving, in areas with hiding cover (tall grass or brush) (Skovlin et al. 2002). At this time, yearlings may be aggressively driven away by the cows (de Vos et al. 1967, Irwin 2002). Single calves (rarely twins) are born after a gestation period of 244 to 265 days; weight at birth is approximately 35 pounds (Hudson et al. 1991, Haigh 1998, Wisdom and Cook 2000, Hudson and Haigh 2002, Peek 2003).

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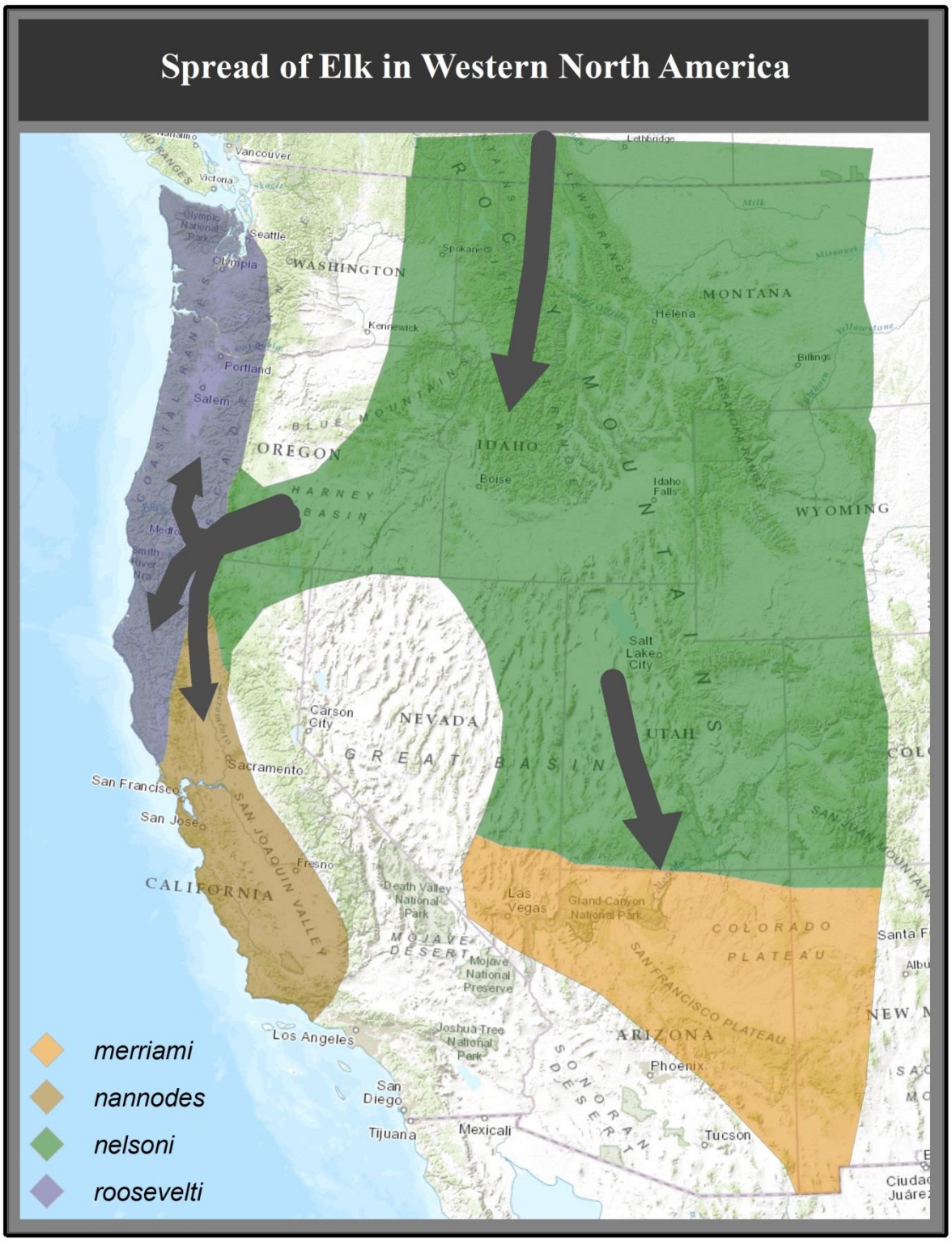

Figure 4. Hypothesized dispersal of elk through western North America (McCullough 1969).

The following is a general description of elk habitat conditions in North America, with an emphasis on conditions and trends within California. Elk habitat consists of an assortment of forest cover and large open areas (Cook 2002). Forest habitat provides escape cover from various types of human disturbance and natural predators, and forest corridors provide pathways among seasonal habitats (Cook 2002, Hudson and Haigh 2002, Peek 2003). Open areas provide forage in the form of grasses and forbs (Cook 2002). Some Roosevelt and Rocky Mountain elk herds migrate from one area to another according to season and weather conditions (Wisdom and Cook 2000, Beck and Peek 2005). Adequate winter habitat in the form of lowland forest cover is important for elk survival. Preserving and managing forests and open areas with elk in mind can assist land agencies and private landowners in supporting elk populations (Cook 2002, Peek 2003). Tule elk find suitable foraging and protective cover in coastal and inland regions of central California. Some of these areas lack trees (e.g., Carrizo Plain area of San Luis Obispo County), and elk appear to use topographic relief as hiding cover (California Department of Fish and Wildlife, unpublished data 2014). Due to the lack of severe weather patterns (no deep snow) in these regions, tule elk do not seasonally migrate (McCullough 1969, Thomas and Toweill 1982).

Elk habitat conditions in California are diverse and vary within each of the seven provinces as identified in the 2015 State Wildlife Action Plan (California Department of Fish and Wildlife 2015). Elk within California occupy numerous habitat types, including coastal coniferous rainforests, coastal prairies, emergent wetlands, grasslands, hardwood forests, juniper, mixed-conifer forests, oak woodlands, shrublands, and sagebrush (Harper et al. 1967, McCullough 1969, Franklin and Lieb 1979, Happe et al. 1990).

Much of the elk habitat in California (over 9 million acres) is public land administered by the USFS and management of those lands has changed dramatically over time. From the gold rush days until the mid-1900s, removal and suppression of fire, logging, and livestock grazing significantly altered California's vegetation communities, converting vast acreages to earlier successional vegetation (Gruell 2001). Changing forest management practices resulted in a decrease of early successional vegetation on federal lands (Lutz et al. 2003). Much of this is due to improved efficiency in fire suppression leading to increased tree densities and a decline in shrub species. Many of the shrubs that are present are mature, and the young, more nutritious, shrubs that benefit elk and deer are less abundant (Kucera and Mayer 1999, Schaefer et al. 2003). As early as the 1970s, the USFS began to recognize that fire suppression was resulting in fuel buildup in the forests, and a new regime of managing rather than controlling fires was started (Gruell 2001). This strategy recognizes the ecological role of fire in increasing forest heterogeneity, but is not yet universally embraced (North et al. 2009).

Although deer populations have declined through time, elk populations have gradually increased. Since carrying capacity is a theoretical concept, the maximum population size for elk within the various provinces of California is unknown. Several factors affect elk habitat quality, such as timber harvest, fire, and conversion of habitats. Timber harvesting activities can provide a source of disturbance to reset vegetation to early seral stages in forested habitats in California, which benefits elk and deer. Data from the California State Board of Equalization (CSBOE) in 2014 demonstrated that the trend on

both public and privately owned land has been a reduction in timber harvest volume through time (Figure 5); however, the rate of decrease has been much greater on public than on private land. Between 1978 and 1988 there was 1.4 times greater volume (board feet) of timber removed from private than public lands. In contrast, between 2003 and 2013 this difference increased to 8.3 times the volume removed from public lands (CSBOE 2014). This suggests that the associated successional change of conifer-dominated habitats to early seral stages from timber harvesting is currently higher on private compared to public lands. There are many other factors that affect habitat quality from timber harvest such as type of harvest (clear cut versus selective harvest) and pre- and post-harvest treatment types (such as herbicide application), but Figure 5 exemplifies a general trend over time.

The BLM administers approximately 1.8 million acres of elk habitat in California. Due to a history of fire suppression and excessive livestock grazing, many shrublands have become senescent and cannot supply the nutrition for ungulates found in early successional stage habitats (Gruell 1996). Rather than resetting shrub succession, fuel buildup supports high intensity fires that typically convert the remaining shrublands to vegetation communities dominated by non-native annual grasses such as cheatgrass (*Bromus tectorum*) which holds very little nutritional value. Additionally, in the Great Basin region of California, vegetation communities continue to be threatened by the encroachment of western juniper (*Juniperus occidentalis)* into sagebrush-grasslands (Schaefer et al. 2003, Bureau of Land Management 2007). Juniper encroachment into sagebrush and bitterbrush habitats has further reduced habitat quality for ungulates by competing with more desirable forage species (Schaefer et al. 2003, Cox et al. 2009).

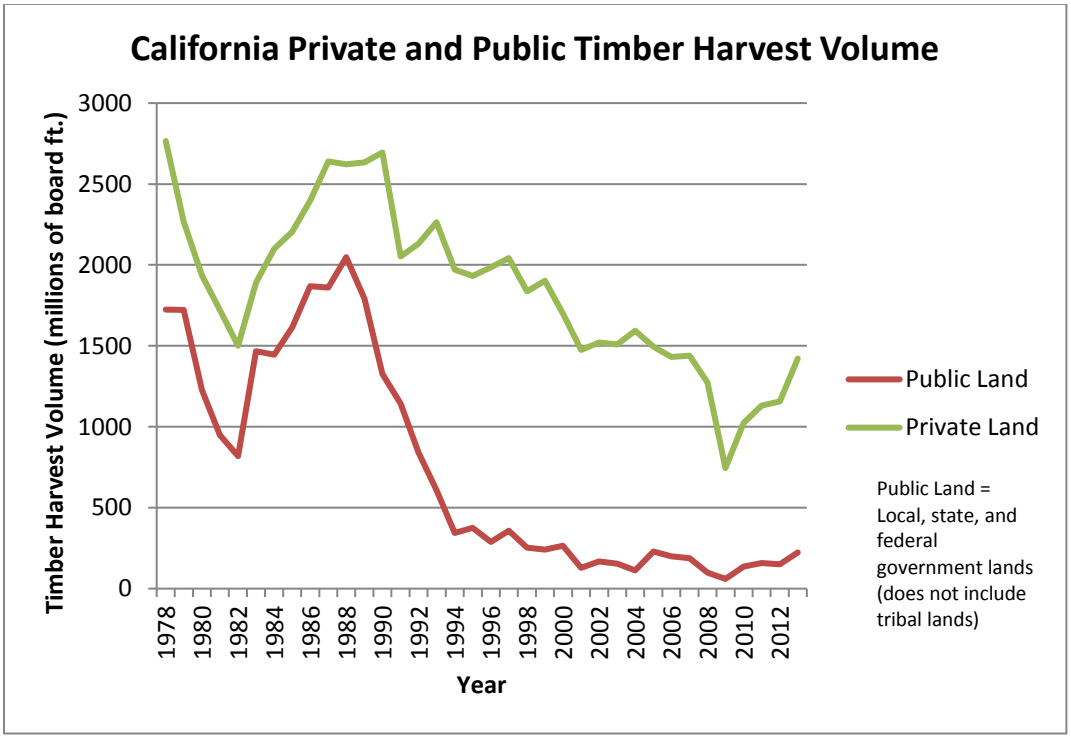

Figure 5. Timber harvested from public and private forests in California from 1978 to 2013 (CSBOE 2014).

Current forage conditions on most elk ranges in California are the result of forest and range management, and livestock grazing practices of the public land management agencies (USFS, BLM, and other public agencies) and private landowners. Although the Department does not manage activities on these lands, it does provide input to the public land management agencies. The Department directly manages only a small fraction of land within current elk range. The Department owns five properties where elk land management activities occur: Grizzly Island Wildlife Area in Solano County, San Antonio Valley Ecological Reserve in Santa Clara County, Cache Creek Wildlife Area in Lake County, North Coast Wildlife Area Complex in Del Norte and Humboldt counties, and the Carrizo Plains Ecological Reserve in San Luis Obispo County. The management activities include controlling invasive weeds, installing water sources, conducting research, and planting food plots.

Elk are opportunistic feeders and they will eat a variety of plant species when the forage is available (Kufeld 1973, Peek 2003). They are classified as intermediate or mixed feeders and can switch from consuming primarily grasses to entirely browse (tender shoots or twigs of shrubs and trees) (Cook 2002, Peek 2003). As summer progresses, elk consume more forbs and woody browse, while in fall the diet switches to mainly dry grasses and browse (Jenkins and Starkey 1991, Cook 2002, Beck and Peek 2005). During winter, elk seek a mixture of grasses, forbs and shrubs to ensure proper intake of nitrogen (Kufeld 1973, Peek 2003). Forage utilization varies significantly between subspecies, habitat types, sex, and geographic locations (Kufeld 1973, Thomas and Toweill 1982, Cook 2002, Bliss and Weckerly 2016).

Elk are fairly long lived, with harvest-reported ages in California up to 19 years for Roosevelt elk, 14 years for Rocky Mountain elk, and 18 years for tule elk (California Department of Fish and Wildlife, unpublished data 2016). Elk herds in California have continued to expand with state regulated hunting and harvest by Tribes and their members on tribal lands. Cause-specific mortality outside of regulated hunting has not been studied in California's elk. Illegal killing of elk by both commercial and non-commercial poachers in California has been implicated as a source of mortality, but the level of poaching is disputed (Hansen 1994). Elk poaching incidents have been recorded in several of California's herds. Hanson and Willison (1983) reported that poaching was found to be the cause of a complete failure of one tule elk translocation when nearly all the animals were poached. Another high profile poaching incident occurred in 2013 when three tule elk bulls were shot and abandoned near Los Banos in Merced County prompting the California Deer Association to offer a reward for information related to the killings (Romans 2013). The Department puts considerable resources into investigating poaching events. However, neither legal nor illegal killing of elk are considered to be limiting factors on established elk herds because the herds continue to expand (California Department of Fish and Wildlife, unpublished data 2015; also see Figure 2). Other human-related mortalities include vehicle collisions and entanglement in fences and other structures. Very few diseases and parasites have been documented in California elk and they are not thought to be limiting factors for California elk (California Department of Fish and Wildlife, unpublished data 2015).

Throughout their North American range, elk are susceptible to predation by numerous carnivores including black bears (*Ursus americanus*), coyotes (*Canis latrans*), gray

wolves (*C. lupis*), grizzly bears (*U. arctos*), and mountain lions (*Puma concolor*) (Barber et al. 2005, Zager et al. 2007, White et al. 2010, Yellowstone National Park (YNP) 2014). Gray wolves and mountains lions are the only predators in California capable of killing a healthy adult elk (Zager et al. 2007, White et al. 2010). In YNP, grizzly and black bears are efficient predators of elk calves while coyotes, wolves, and mountain lions will also occasionally kill calves (Griffin et al. 2011, Yellowstone National Park 2014). An ongoing study in Idaho revealed higher than expected predation of calves by black bears (Barber et al. 2005, White et al. 2010). Black bears have been observed stalking and killing elk calves in Mendocino and Siskiyou counties (S. Koller and R. Schaefer, California Department of Fish and Wildlife, personal communication, 2015). The overall impact from black bear, coyote, and mountain lion predation on elk in California is not fully known and predation rates on elk likely vary among herds. As the gray wolf reestablishes in northern California, no information exists on their specific impact to elk in the state. Consequently, information from other states is all that is currently available. The conservation plan for gray wolves in California evaluates potential impacts from predation on elk based on information in other studies, but actual impacts are not known and will most likely vary with individual herds of elk (Kovacs et al. 2016).

D. Distribution and Population Status

Figure 3 depicts the estimated historical distribution of elk in California. Prior to European arrival, approximately 42% (42.7 million acres) of California's land base supported elk and they were considered abundant (Murie 1951). While a reliable statewide population estimate prior to European settlement is unavailable, McCullough (1969) considered 500,000 tule elk a reasonable estimate.

The decline of elk in California generally correlated with their demise in other states and provinces throughout North America (Bryant and Maser 1982), where the Eastern (*C. c. canadensis*) and Merriam (*C. c. merriami*) subspecies were driven to extinction in eastern and southwestern portions of the continent. The decline of California elk is well-documented (Evermann 1915, Doney et al. 1916, Barnes 1925*a* 1925*b*, Ellsworth 1930, Dow 1934, Graf 1955, Harper et al. 1967, McCullough 1969, Tule Elk Interagency Task Force 1979, Fowler 1985, Koch 1987). Briefly, non-indigenous human settlement decimated California's elk; specific adverse activities included market shooting for the fur/hide, tallow, and meat trades, introduction of exotic plants (particularly annual grasses) along with feral/domesticated cattle and horses, and the onset of the gold rush era (Harper et al. 1967, McCullough 1969).

Efforts to translocate elk in California occurred sporadically during the early 1900s and generally met with limited success (McCullough 1969, Dasmann 1975). In 1970, elk in California occupied less than 10% of their historical range (Figure 6); their distribution and abundance declined precipitously during the latter part of the 1800s and remained so for decades.

Tule Elk

By 1970, isolated tule elk herds existed in the Owens Valley (Inyo County), at Cache Creek (Colusa and Lake counties), and within an enclosure in Kern County (McCullough 1969). State and federal legislation in the 1970s (i.e., Behr Bill [SB 722] 1971 and Public Law 94-389, 1976) focused specifically on reestablishing tule elk. The Behr Bill directed the Department to reestablish tule elk at suitable locations, whereas Public Law 94-389 required the Secretaries of Defense, Agriculture, and the Interior to cooperate with the State in making suitable federal lands reasonably available for elk. Subsequent to the state and federal legislation, more than 1,250 tule elk have been captured and

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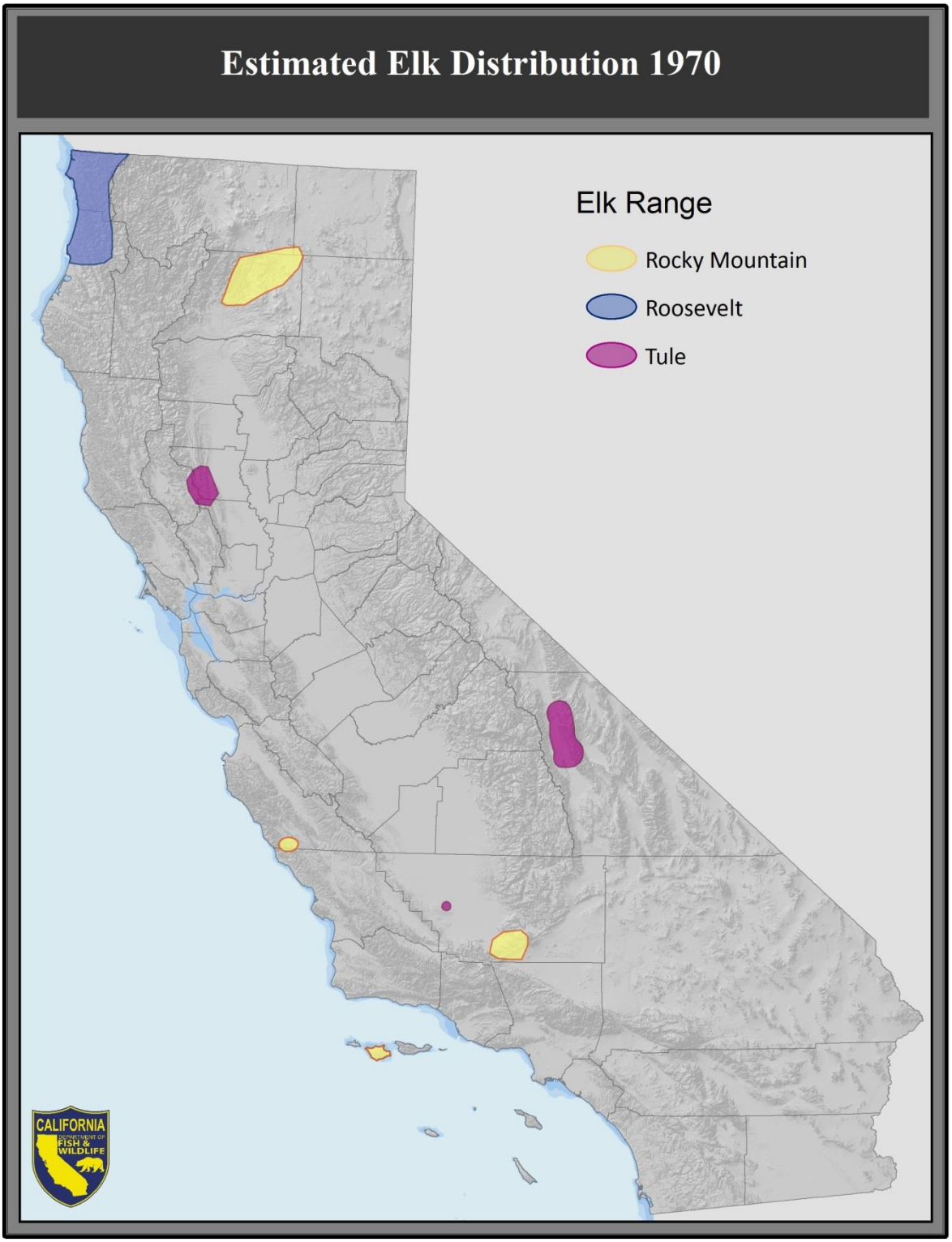

Figure 6. Estimated distribution of elk in California, 1970.

moved to reestablish and augment herds at more than 20 locations in California. Details of specific capture and translocation efforts for each location appear in Appendix E.

Roosevelt Elk

The distribution of Roosevelt elk in 1970 focused on the Big Lagoon and Prairie Creek areas of Humboldt County, and to a lesser extent, a portion of Del Norte County (Harper et al. 1967; see Figure 6). In contrast to tule elk, Roosevelt elk translocation efforts were driven more by local interests than state or federal legislation. For example, from 1947-1965 the Department translocated 16 bulls and 35 cows from Prairie Creek to Bear Basin (Del Norte County), at least in part at the request of the Del Norte County Rod and Gun Club (O'Brien 1966). This effort initially was considered "moderately successful" (California Department of Fish and Game 1959), but later was determined to be unsuccessful (O'Brien 1966). Observations at the time by the Department area biologist suggests the translocated elk returned to the Prairie Creek area from the release site.

From 1982-1984, the Department translocated 24 Roosevelt elk from Redwood National Park (RNP) to the BLM King Range National Conservation Area (McCoy 1986). Elk are re-established on public and private land near the King Range in southern Humboldt and northern Mendocino counties. In 1985, the Department began reintroducing Roosevelt elk from RNP to the Happy Camp area of Siskiyou County. This initially began as a cooperative effort between the Department, Klamath National Forest (KNF), and RNP. Later, the Oregon Department of Fish and Wildlife provided source stock from multiple sites in Oregon, so translocation efforts expanded to involve multiple release sites in Siskiyou and Trinity counties. From 1982 through 2000, more than 350 Roosevelt elk were translocated to reestablish populations in portions of southern Humboldt, Mendocino, Siskiyou, and Trinity counties.

Roosevelt elk also reestablished at several other northern California locations by dispersal, either from translocation sites discussed above, or from established populations in northern California and Oregon. For example, sightings of Roosevelt elk near Grass Lake in eastern Siskiyou County were reported as early as 1965 (California Department of Fish and Wildlife, unpublished data 2015). Elk are well established in the Grass Lake area, which is within the Siskiyou management unit.

Rocky Mountain Elk

Translocation of Rocky Mountain elk to California occurred on at least three occasions prior to 1970. In 1913, the Redding Elks Club purchased 50 Rocky Mountain elk from YNP for release in the Pit River area of Shasta County (Smith and Murphy 1973). The initial release apparently was augmented shortly thereafter by the accidental release of 24 elk from a stalled train in the Sacramento River Canyon (California Department of Fish and Game 1959). Additionally, a private effort to establish Rocky Mountain elk in Kern County occurred in 1967 with the release of 277 elk within a fenced enclosure on the Ellsworth Ranch. Rocky Mountain elk persist in parts of Shasta and Kern counties today.

In response to periodic Rocky Mountain elk sightings reported in Modoc County during the early 1990s, the Department used radio telemetry to monitor elk distribution and movement during 1993 and 1994 (Ratcliff 1994). Results of observations and surveys

demonstrate that elk are established in the Northeastern California Unit and expanding their range into other parts of Modoc County along with portions of Lassen, Plumas, Shasta, Sierra, and Siskiyou counties.

Current Distribution and Population Trends

The current distribution of elk in California (Figure 1) has expanded significantly and occupied range has increased by over 500% since 1970 (California Department of Fish and Wildlife, unpublished data 2015). Successful translocation efforts contributed to this range expansion. The expansion of tule elk range is especially significant; with intensive reintroduction efforts from the mid-1970s until 1998, when the most recent herd was established in the San Emigdio Mountains of Kern County. Additionally, successful reintroduction efforts from 1982 until 2000 contributed to expansion of Roosevelt elk range into portions of Siskiyou, Trinity, and southern Humboldt/northern Mendocino counties. The availability of suitable elk habitat and the ability of elk to disperse into those habitats also contributed to their range expansion in California. Rocky Mountain elk currently inhabit portions of northeastern California far from known release sites. Similarly, tule elk herds have become established more than 20 miles away from initial release sites. These include the Alameda (Alameda County), East Park Reservoir and portions of the Bear Valley (Colusa, Glenn, and Lake counties), La Panza (San Luis Obispo County), and Owens Valley (Inyo County) herds. Elk occupy large and diverse geographic areas of the state and population densities vary by locality and habitat type. Most elk populations in California are slowly increasing (California Department of Fish and Wildlife, unpublished data 2015). It must be noted that elk are absent from large areas within current elk range and it is likely that in many areas densities are at less than historical (i.e. pre-European) levels.

Figure 2 depicts increasing population trends for tule and Roosevelt elk in California since 1970. Currently there are approximately 5,700 tule elk throughout California in numerous herds, and Roosevelt elk in northern California are estimated at 5,000 to 6,000 individuals (California Department of Fish and Wildlife, unpublished data 2015). There are four known populations of Rocky Mountain elk totaling 1,500 animals in portions of Kern, Lassen, Monterey, Modoc, Plumas, San Luis Obispo, Shasta, Sierra and Siskiyou counties. Figure 2 depicts a stable (unchanged) trend in Rocky Mountain elk (particularly since 1986); however, the Department lacks sufficient information regarding Rocky Mountain elk population size to make any trend inferences.

Elk Management Units

Twenty-two high priority areas for elk management, referred to as Elk Management Units (EMUs), are identified in California (Figure 7). Individual EMU boundaries are based on current and potential distribution and generally correspond with existing elk hunt zone boundaries (in instances where public hunting zones have been established). Because elk are free ranging over large geographic areas, boundaries are generally expansive. Although EMU boundaries are based on current and potential distribution, future elk distribution may expand beyond established boundaries and additional EMUs may be established or existing boundaries altered as elk distribution changes.

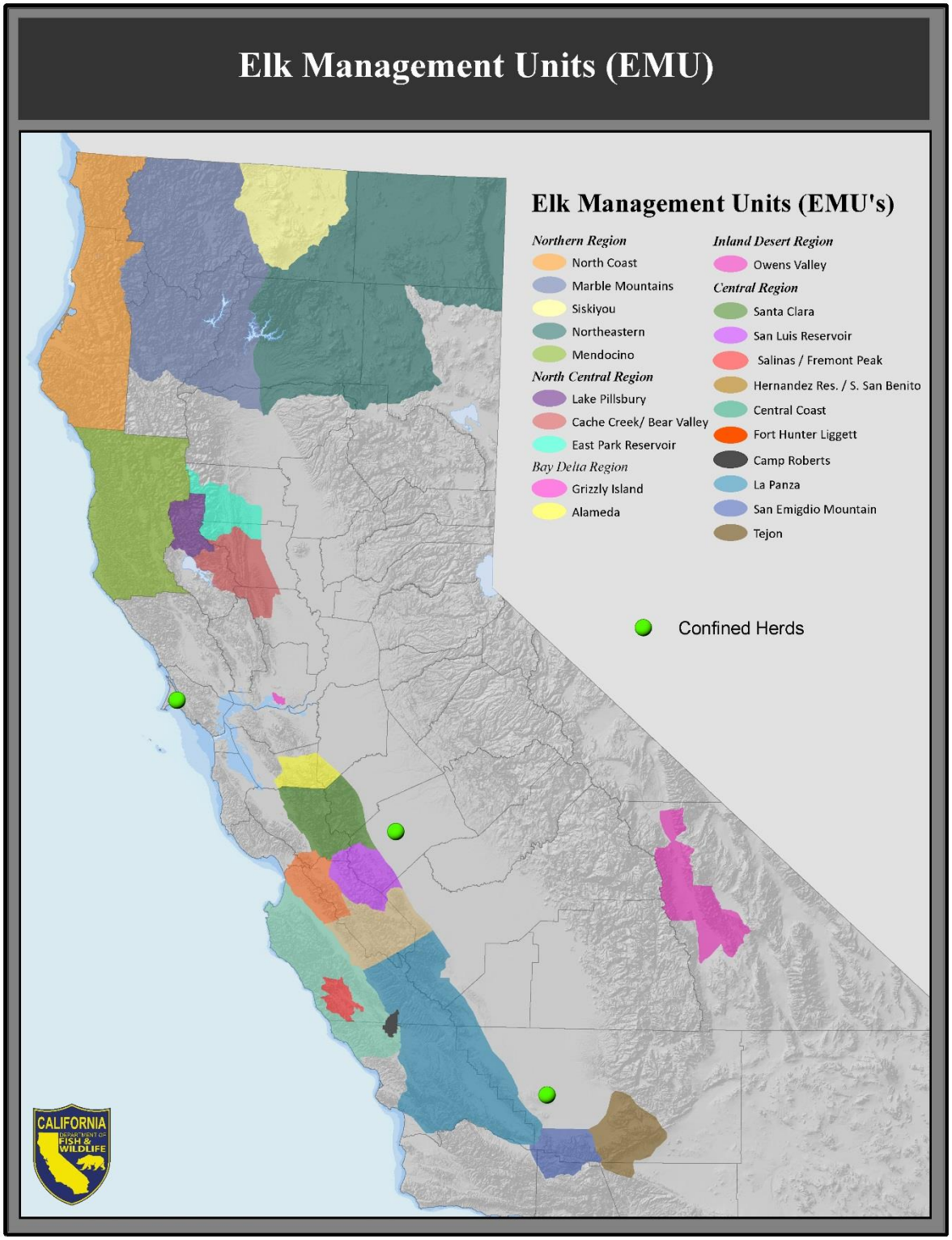

Figure 7. Elk Management Units, 2016.

Individual management documents have been prepared for each EMU depicted in Figure 7 (Appendix E). Each EMU document describes specific habitat types and vegetation characteristics, along with land use practices and recommendations for specific conservation and management activities. The documents identify area-specific needs and issues, including population monitoring, habitat conditions/trends, harvests, herd viability, land use conflicts, and recommended management actions. Within the EMU framework, the Department will work to understand habitat utilization, connectivity between habitats, and overall elk distribution across the landscape. Table 2 summarizes the goals and objectives for each EMU.

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Management Goal	Management Objectives*	North Coast	Marble Mountains	Siskiyou	Northeastern	Mendocino Roosevelt	Mendocino Tule	Lake Pillsbury	Cache Creek/Bear Valley	East Park Reservoir	Grizzly Island	Alameda	Santa Clara/Mount Hamilton	Salinas/Fremont Peak	San Luis Reservoir	Central Coast	Hernandez Res./S. San Benito	La Panza	Fort Hunter Liggett	Camp Roberts	Owens Valley	San Emigdio Mountain	Tejon	Confined Herds
Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change	Continue/complete projects to estimate population abundance, distribution, habitat use, and demographics to provide managers with additional information to make adaptive management decisions	2023	2023	2023	2023	2023	2023	2024	2024	2024	OG	2023	2023	2024	2023	2023	2024	2023	2025	2023	2023	2023	2024	NA
	Increase/maintain elk populations in areas where human-elk conflicts are expected to be minimal	2028	2028	2028	2028	2028	2028	2028	2028	2028	NA	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	OG	NA
	Enhance or increase elk habitats by at least 5%	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	NA
	Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease)	2023	2023	2023	2023	2025	2025	2025	2025	2025	NA	2023	2023	2024	2023	NA	2024	2024	NA	NA	2025	2025	NA	NA
	Collaborate with Caltrans to provide information and recommendations to reduce vehicle collisions	2023	NA	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	NA
	Determine the prevalence and significance of exotic lice on tule elk	NA	NA	NA	NA	NA	NA	2025	NA	NA	NA	NA	NA	NA	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Determine habitat relationship between elk, livestock, and feral horses	NA	NA	NA	2028	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Maintain population within EMU objective and composition	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	NA
Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape	Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit	2021	2021	2021	2021	2021	2021	NA	2021	NA	NA	NA	NA	NA	NA	2021	NA	NA	NA	NA	2021	NA	NA	NA
	Work with Tribes to complete monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat	2023	2023	2023	2023	2023	2023	NA	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2023	NA	NA	NA

*Individual EMUs contain detailed management objectives in addition to those identified in the overall goals and objectives in Table 1. Specific objectives within EMUs may be worded differently than the objetives listed here to account for differences within EMUs. NA - Not Applicable, OG - Ongoing

Table 2. Elk Management Unit Goals and Objectives.

Management Goal	Management Objectives*	North Coast	Marble Mountains	Siskiyou	Northeastern	Mendocino Roosevelt	Mendocino Tule	Lake Pillsbury	Cache Creek/Bear Valley	East Park Reservoir	Grizzly Island	Alameda	Santa Clara/Mount Hamilton	Salinas/Fremont Peak	San Luis Reservoir	Central Coast	Hernandez Res./S. San Benito	La Panza	Fort Hunter Liggett	Camp Roberts	Owens Valley	San Emigdio Mountain	Tejon	Confined Herds
Enhance/develop opportunities for public use and enjoyment of elk that include hunting and wildlife viewing	Increase/maintain/develop elk hunting opportunities where feasible and compatible with population objectives	2023	2023	2023	2023	2023	2023	2023	2023	2023	2021	OG	OG	2023	2023	2025	2023	2023	OG	2020	OG	2022	2023	NA
	Work with other agencies and NGOs to install elk interpretive signs	2-2023	NA	NA	NA	NA	NA	1-2024	1-2024	1-2023	1-2024	1-2024	1-2024	NA	1-2023	NA	NA	1-2023	NA	NA	2-2023	NA	NA	NA
	Conduct elk workshop to inform the public about elk and elk viewing opportunities	2023	NA	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2023	NA	NA	2023	NA	NA	NA
	Increase elk viewing and educational opportunities	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2023
	Provide information on the Department web page to inform the public about elk and elk viewing opportunities	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
Alleviate human-elk conflicts and elk depredation complaints	Reduce reports of human-elk conflicts on private property by at least 25%	2023	2023	2023	2023	NA	2023	NA	2023	2023	NA	NA	NA	2023	2023	2023	2023	2023	2025	2025	2023	NA	NA	NA
	Continue to monitor human-elk conflicts on private property	NA	NA	NA	NA	OG	NA	NA	NA	NA	NA	OG	OG	NA	NA	NA	NA	NA	NA	NA	NA	OG	OG	NA
Reduce the number of confined herds and the frequency for removing excess animals	Eliminate one or more confined herds	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2025
	Reduce population levels within enclosures and identify preferred population control methods.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2025
Enhance habitat wtihin enclosures	Enhance elk habitats by at least 5%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2028

*Individual EMUs contain detailed management objectives in addition to those identified in the overall goals and objectives in Table 1. Specific objectives within EMUs may be worded differently than the objetives listed here to account for differences within EMUs. NA - Not Applicable, OG - Ongoing

Table 2. Elk Management Unit Goals and Objectives (continued).

Updates to individual EMUs will occur as additional data is collected and to reflect co-management agreements, memoranda of agreement, or similar mechanisms with Tribes affiliated with the EMU. An EMU document was prepared specific to three confined herds at Tupman Tule Elk State Reserve (Kern County), San Luis National Wildlife Refuge (Merced County), and Point Reyes National Seashore (PRNS) at Tomales Point (Marin County). An EMU document has not yet been prepared for the PRNS free ranging elk herd. The Department is working cooperatively with PRNS staff as they develop a Comprehensive Management Plan/Environmental Assessment regarding elk management; its contents will be incorporated into an EMU document for the PRNS elk herd when that plan is completed.

E. Historical and Ongoing Management Efforts by the Department and California Tribes

As discussed previously, historical translocation efforts contributed to the recovery of elk populations in California. Other historical elk management activities included periodic administration of regulated hunting prior to 1986, with annual hunting in some locations after 1986. Additional management efforts involved monitoring pathogens/parasites, distribution/movement, habitat use, food studies, population demographics, and genetic/Deoxyribonucleic Acid (DNA)/contraceptive analyses.

With the expansion of elk range in California since 1970, the need for surplus elk for additional reintroductions and further expansion has diminished. Much of the historical suitable habitat now supports elk, although at densities likely less than those prior to European settlement of the state in many areas. However, an important management goal is to sustain or increase elk populations. Ongoing and future management efforts will likely involve translocation of surplus elk to improve the status of an existing population, maintain or increase genetic interchange between isolated populations and to recolonize elk to their historical ranges.

It is noteworthy that under protection and regulated harvest, California elk have demonstrated patterns of population growth. This growth has resulted in depredation complaints and other conflicts on private property, and deterioration of habitat conditions and/or the physical condition of individual animals on public property. These conflicts are well documented with tule elk (McCullough 1969, Fowler 1985, Koch 1987), Roosevelt elk (California Department of Fish and Game 1959, Harper et al. 1967, California Department of Fish and Wildlife, unpublished data 2015), and Rocky Mountain elk (California Department of Fish and Game 1959). Previous management efforts involved developing methods to alleviate/resolve depredation complaints, private property conflicts, and/or public safety incidents. As conflicts between expanding elk and human populations continue in California, these activities will likely become increasingly important. The Department will need to identify additional methods of alleviating conflicts as it balances the need to control population numbers with the directive to maintain elk populations in perpetuity.

California Tribes currently and historically managed elk habitat and hunted elk for food, materials, medicine and regalia. Elk play a prevalent cultural role in many Tribes both historically and to present day. Because of the holistic nature of many tribal cultures,

this connection is a reciprocation, integrating into the far reaches of ceremony and prayer. Many Tribes have traditional laws, oral traditions, and ceremonies that incorporate specific land management practices for elk, including seasonal application of prescribed fire to support elk habitat (early successional vegetation) and regulations of take based on seasonal ecological indicators and herd population dynamics. Historically, this reciprocation resulted in management of the landscape for the mutual benefit of tribal members and the elk population and held a steady place in their cultures.

Due to fire suppression, habitat loss, and hunting for meat and hides, extirpation of nearly all elk from most tribal ancestral territories occurred as early as 1870. Due to various re-introduction efforts, elk have returned to many, but not all of these areas. Tribes remain interested in the re-introduction of elk to tribal lands within the historical range of elk. Several Tribes have expressed interest in establishing elk on their lands. The Department will work with Tribes interested in establishing elk and those Tribes whose aboriginal territory may represent a source of elk for translocation. These activities may necessitate the development of additional EMUs for areas within historical elk range but outside of current EMU boundaries.

Elk are an important resource and an ecosystem management indicator for many Tribes. As part of current tribal management, Tribes have used prescribed burns to support elk habitat and accomplish vegetation and watershed management objectives. While achieving these objectives, Tribes have also considered the habitat needs of other culturally and legally significant species such as spotted owl, California condor, porcupine, tan-oak, and salmon. Opening up meadows for summer habitat on ridgelines, transitional dispersal corridors and wintering habitat along river bottoms serves multiple social, economic and ecological landscape values. In this context, elk fit into a strategic landscape-scale restoration effort that utilizes rotational seasonal burns at different elevation bands according to seasonal habitat needs of elk, such as forage, cover, and calving (Sarna and Tucker 2016). The wide-ranging and migratory nature of elk coupled with a need to engage in consistent management that crosses jurisdictional boundaries makes co-management with Tribes necessary for effective elk management and persistent thriving elk populations throughout their historical range.

The need for funding elk inventory, monitoring, research, and conservation will continue to increase. In 2011, Senate Bill 1058 became law (FGC §3953). This legislation mandated that all revenue from the sale of antelope, elk, deer, wild pig, bear, and sheep tags, including fund-raising tags, be deposited into the Big Game Management Account (BGMA) to provide separate accountability for the receipt and expenditure of those funds. Permitted uses for these funds include acquiring land, completing projects, implementing programs to benefit big game, and expanding public hunting opportunities and related public outreach. Funds may also be used for administrative and enforcement costs of the programs and activities. In addition to revenue generated by big game tag sales, programs also apply for and receive Federal Wildlife Restoration funds (known historically as the Pittman-Robertson Act or “PR” funds). Prior to establishment of the BGMA, the elk program relied heavily on revenue from annual fund-raising hunt tags (which varied from year to year) and PR funds.

II. CONSERVATION AND MANAGEMENT

A. Adaptive Management

Adaptive management is a flexible decision-making process for ongoing knowledge acquisition, monitoring, and evaluation leading to continuous improvements in management planning and implementation of projects to achieve specified objectives. An adaptive management approach provides a structured process that allows for taking action under uncertain conditions based on the best available science; then closely monitoring and evaluating outcomes and re-evaluating and adjusting decisions as more information is learned. Adaptive management will become increasingly important as the projected impacts of climate change to wildlife and plants unfold on the landscape (National Fish, Wildlife and Plants Climate Adaptation Partnership 2012). As outlined in the plan, such information, in addition to data from inventory, research and monitoring will inform implementation of goals and objectives.

B. Population Monitoring

Reliably estimating population numbers is a challenging and expensive wildlife management activity. Methods used by the Department vary by individual area . The methods include: fixed-wing airplane and helicopter surveys, ground counts, camera traps, opportunistic surveys, monitoring harvest results, age data (from teeth), and DNA analysis of tissue and fecal samples. The Department does not have the resources required to intensively monitor all the elk herds on an annual basis.

Aerial surveys in much of northern California, including Humboldt, Del Norte, Trinity, and parts of Siskiyou counties, are not effective methods of counting elk because of dense forest canopies, steep hillsides, and low densities of elk. Wildlife surveys in these areas present many challenges and statistically robust population estimates have not been possible to obtain to date. As part of an effort to develop methods that better measure and monitor elk populations the Department is utilizing DNA analysis (both fecal and tissue). Initial results from both elk and deer suggests that this method can be an efficient and cost-effective approach to monitor populations where aerial surveys are infeasible due to terrain or canopy closure. The Department will continue these efforts in the appropriate areas.

Elk numbers have been assessed using a combination of population census/survey techniques. In some parts of the state, helicopter surveys occur on a three-year rotation. In other areas, with open habitat conditions and sufficient staffing to monitor population parameters more frequently, ground counts and/or fixed winged surveys occur annually. These areas include portions of Inyo, Kern, Lake, Merced, Monterey, and San Luis Obispo counties.

Seldom, except for specific localized research projects, do wildlife agencies attempt anything other than broad estimates of wildlife population parameters (Raedeke et al. 2002, Montana Department of Fish Wildlife and Parks 2004). Rather, for management

purposes, trend counts measure the relative change in population numbers between years (Raedeke et al. 2002). By monitoring using the same techniques and protocols through time, the Department can use the data to determine population parameter trends relative to past years or management objectives. By comparing these indices, the Department can determine the effectiveness of management decisions in achieving population goals. This is consistent with how other states such as Oregon, Montana, and Washington collect and review data for elk herds (Oregon Department of Fish and Wildlife 2003, Montana Department of Fish Wildlife and Parks 2004, Washington Department of Fish and Wildlife 2014*a*, 2014*b*).

Much of the elk population data collected in California is based on minimum population counts and is used in conjunction with age and harvest data to establish tag quotas. Currently the Department uses a variety of standardized survey techniques to estimate population parameters. Table 3 illustrates the survey methods currently used within the EMUs. Systematic surveys have not been conducted in some areas (e.g. Siskiyou EMU) due to the limitations discussed previously. The Department will establish standardized survey protocols for elk through this plan. Estimation techniques that account for detection probabilities include: sightability correction models (Samuel et al. 1987, Gilbert and Moeller 2008), distance sampling (Thomas et al. 2002), and mark-resight techniques (McCorquodale et al. 2012). The application of one or more of these approaches is likely to be appropriate to generate formal population or trend estimates for many of the EMUs. The Department is in the process of implementing additional techniques (such as fecal DNA analysis) not identified within Table 3 because they are currently not fully operationalized. Each EMU document lists techniques used for population monitoring (Appendix E), and identifies units needing improved or additional monitoring.

EMU	Helicopter	Fixed-wing	Ground	Camera Trap	Opportunistic Surveys
Alameda/San Joaquin	X	X			X
Cache Creek	X		X		
Camp Roberts	X		X		
Central Coast	X		X		
East Park/Bear Valley	X				
Fort Hunter Liggett			X		
Grizzly Island			X		
La Panza	X	X			
Lake Pillsbury			X		
Marble Mountains			X	X	
Mendocino Roosevelt			X		
Mendocino Tule			X		
North Coast			X	X	X
Northeastern	X			X	
Owens Valley	X	X	X		
Point Reyes-Free Range			X		
Salinas/Fremont Peak	X				
San Emigdio Mountain			X		
San Luis Reservoir	X	X			
Santa Clara/Mount Hamilton	X		X		
Siskiyou					X
Confined Herds			X		

Table 3. Existing survey methods conducted within Elk Management Units, 2016.

C. Herd Viability and Genetic Diversity

Consistent with state policy to conserve wildlife resources (FGC §1801), one goal of California's elk management plan is to maintain sufficient elk populations in perpetuity. In addition, FGC §3952 directs the Department to consider "methods for determining population viability and the minimum population level needed to sustain local herds". The FGC does not define population viability or otherwise quantify the minimum level needed to sustain a herd. Federal regulations provide some clarification and define a viable population as "a population of a species that continues to persist over the long term with sufficient distribution to be resilient and adaptable to stressors and likely future environments" (USDA Forest Service 36 CFR 219.19).

The Department's examination of elk population viability began with a review of scientific papers that discussed viability of wildlife populations, particularly elk. The Department also reviewed elk management plans and related documents prepared by state and federal agencies responsible for managing well-established herds (especially

within the Rocky Mountain Region of the United States) to see how they viewed population viability.

The 1973 Federal Endangered Species Act (16 USC §1531 et seq.) directed federal agencies (e.g., United States Fish and Wildlife Service [USFWS], National Marine Fisheries Service, National Park Service [NPS] and USFS) to examine the viability of listed and candidate species. This has elevated the importance of population viability analysis (PVA) within the scientific community during the last few decades (Shaffer 1981, Boyce 1992, Akcakaya and Sjogren-Gulve 2000, Gerber and Gonzalez-Suarez 2010). Boyce (1992) described PVA as a process of evaluating demographic, distributional, environmental and genetic data to determine the likelihood that a species will persist into the future for a chosen time period. Akcakaya and Sjogren-Gulve (2000) considered PVA important to conservation and planning efforts, along with alternative methods such as habitat suitability models, Gap Analysis (Scott et al. 1993) and reserve selection algorithms.

The National Forest Management Act has directed the USFS to preserve viable wildlife populations on land under its jurisdiction. Table 4 summarizes elk population status for selected forests in the western United States that identified elk as a Management Indicator Species (MIS) or Big Game (BG) in the Land and Resource Management Plan (LRMP). When specified, Minimum Viable Population (MVP) size estimates for elk in LRMPs ranged from 1,500 on the Salmon National Forest, to 3,000 on the Gallatin National Forest. MVP estimates generally pertained to land within forest boundaries, but in some cases, additional elk inhabit adjacent or surrounding property managed by other federal agencies, Tribes, state agencies or private owners. When land uses are compatible, the occurrence of elk on adjacent property and their movement across jurisdictional boundaries can enhance population viability across the landscape.

Not all forests in Table 4 established MVP levels for elk; moreover, how these levels were determined is unclear. LRMPs prepared during the 1980s and 1990s often specified MVP levels for elk. However, guiding processes for LRMP preparation have subsequently changed (USDA Forest Service 2012); some LRMPs have been revised or amended numerous times and no longer specify MVP levels for elk.

Table 5 summarizes elk population status for states in the Rocky Mountain Region, based on statewide management plans and related documents. None of the states identified in Table 5 specified a minimum viable elk population and they all considered translocation/reintroduction important. Statewide elk management plans generally do not specify or calculate MVP levels. Many states also do not list statewide elk population objective levels; however, population objective levels for individual herds, units or zones are identified within the respective EMUs.

Forest **State** **Size in acres**	**ELK POPULATION STATUS** **Reported Size (Year or Season in Parenthesis)** **Potential (projected maximum) Size** **Population Objective** **Minimum Viable Population (MVP) Level**	**Notes/Sources** **USDA Forest Service**
Gallatin National Forest MT 1.7 million acres	Reported Size: 9,800 elk; 5,600 winter on Forest (1987) Potential Size: 12,640; 8,400 winter on Forest Population Objective: not quantified MVP: 3,000; 1,900 winter on Forest	Elk considered MIS. Source: 1987 Gallatin National Forest LRMP.
Challis National Forest ID 2.5 million acres	Reported Size: 5,058 elk (1981) Potential Size: 9,727 elk Population Objective: not quantified forest-wide MVP: 2,054 elk	Elk considered MIS. MIS objectives quantified for management zones. Consolidated with Salmon National Forest in 1998. Source: 1987 Challis National Forest LRMP.
Salmon National Forest ID 1.8 million acres	Reported Size: 5,500 elk Potential Size: 10,300 elk Population Objective: 7,365 elk MVP: 1,500 elk	Elk considered MIS, BG. Objective based on Idaho Dept. Fish and Game Elk Management Plan. Consolidated with Challis National Forest in 1998. Source: 1988 Salmon National Forest LRMP.
Coconino National Forest AZ 1.8 million acres	No reported population levels or objectives. General goal to maintain MIS populations at current levels.	Elk considered MIS, BG. Source: 1987 Coconino National Forest LRMP
Fishlake National Forest UT 1.5 million acres	Reported Size: 2,000 elk (winter) Potential Size: not specified Population Objective: 3,400 elk (3,060 on Forest) MVP: not quantified	Elk considered MIS, BG. Objectives based on Utah Division of Wildlife Resources (DWR) objectives Source: 1986 Fishlake National Forest LRMP
Manti-LaSal National Forest UT 1.3 million acres	Reported Size: 4,390 elk (1980) Potential Size: 13,650 elk on/adjacent to Forest Population Objective: 6,600 (1990) MVP: 2,125 elk	Elk considered MIS, BG. Objectives and reported numbers from Utah DWR Source: 1986 Manti-LaSal National Forest LRMP
Wenatchee National Forest WA 2.1 million acres	Reported Size: 5,600 elk (winter); 12,000 elk (summer) Potential Size: 20,000 elk Population Objective, MVP not quantified	Elk considered MIS, BG. Now Okanogan-Wenatchee National Forest Source: 1990 Wenatchee National Forest LRMP
Gifford-Pinchot National Forest WA 1.4 million acres	Reported Size: 5,230 elk (winter) Potential Size: not specified Population Objective: maintain close to current level MVP: not quantified	Elk considered MIS, BG. (*C. c. roosevelti*) subspecies Source: 1990 Gifford-Pinchot National Forest LRMP
Gila National Forest NM 3.3 million acres	Reported levels for 38 management areas ranged from 0-1,820 elk. Potential (projected) levels ranged from 0-2,250 elk. Population Objective, MVP not quantified.	Elk considered Primary Game Species. Source:1986 Gila National Forest LRMP
Ochoco National Forest OR 1.7 million acres	Reported Size: 2,300 elk Potential Size: 4,040 elk Population Objective: 2,600 elk MVP: not quantified	Elk considered MIS, BG Source: 1989 Ochoco National Forest LRMP
Umatilla National Forest OR and WA 1.4 million acres	Reported Size: 21,135 elk (1983) Potential Size: 21,500 elk Population Objective: 21,056 elk (1983) MVP: not quantified	Elk considered BG Source: 1990 Umatilla National Forest LRMP.

Table 4. Elk population status for selected national forests in the western United States that identified elk as a Management Indicator Species (MIS) or Big Game (BG).

State	Reported Elk Population Level (subspecies) (year)	Statewide Elk Population Objective	Herd/Unit/Zone Population Objectives	Sources
Montana	115,500 (*nelsoni*) (2009)	Not Quantified	Specified in 44 Individual Management Unit Plans (range from "few" to 11,200 elk)	2004 Statewide Elk Management Plan, Walker 2011.
Idaho	107,000 (*nelsoni*)	Not Quantified	28 Zones (Objectives range from <500 – 11,000 elk).	2014 Statewide Elk Management Plan.
Utah	81,000 (*nelsoni*)	71,000 (sum of individual unit objectives)	38 Units. (Objectives range from 0-12,000 elk).	2015 Statewide Elk Management Plan.
Colorado	265,000 (*nelsoni)* (2011)	Not Quantified	36 Elk Units. Most population objectives involve several thousand elk.	Individual Herd/Zone/Unit Management Plans, Holland and Bergman 2014.
Oregon	60,000 (*nelsoni)* 60,000 *(roosevelti)*	72,050 *(nelsoni)* 72,450 *(roosevelti)*	Winter population objectives established for 35 *nelsoni* and 24 *roosevelti* units; range from 120-8,000 elk.	2003 Statewide Elk Management Plan. 2016 Elk Management Objectives for Roosevelt, Rocky Mountain Elk.
Nevada	16,000 (*nelsoni)*	Not Quantified	18 Units/Unit groups identified. Plans prepared for some units	1997 Statewide Elk Management Plan, 2015-2016 Big Game Status Report.
Washington	56,000-60,000 (*nelsoni*, *roosevelti,* hybrids)	Not Quantified	Management Plans for 10 major herds. Objectives range from 1,755-12,485 elk.	2015-2021 Game Management Plan (Dec, 2014).
Arizona	32,000 (*nelsoni*) (2009*)*	Not Quantified	5 Regional Herd Plans (numbers estimated from models, surveys).	2013 Statewide Elk Management Plan (includes 5 Regional Herd Plans). Walker 2011.
New Mexico	66,700 (*nelsoni*) (2009)	Not Quantified		Walker 2011.
Wyoming	110,000 (*nelsoni)* (2009)	Not Quantified		Shultz and Lutz 2014.

Table 5. Elk Population Status reported by State Agencies, Western United States.

Elk are especially important within the Rocky Mountains, and perpetuating wildlife populations is a primary goal of state wildlife agencies. Perhaps many agencies did not specify elk MVP size because their elk populations have increased steadily during past decades (Bunnell et al. 2002) and exceed any perceived threshold that might threaten their persistence. While periodic fluctuations might occur (especially within individual management units), cumulative mortality effects have not jeopardized statewide elk populations in recent decades (Bunnell et al. 2002). States in Table 5 are adjacent to other states with elk and natural movement occurs across borders. Translocation contributed to recovery of North American elk during the 20th century (Table 5; Wolfe et al. 2002), and continues as a management option in the event of a cataclysmic decline. Thus, because elk status in the Rocky Mountain Region is stable and/or improving, specifying elk MVP size statewide does not appear to be a priority for wildlife agencies. In considering elk population viability, the Department concludes that there is controversy in determining how large a population should be to ensure persistence. This is attributed to varying assumptions, including inconsistent/conflicting methodologies and variations in observed environmental parameters (e.g., habitat conditions, population demographics, dispersal, predation, parasites/pathogens, density

dependence, genetics, stochastic events and a host of other factors). It is beyond the scope of this management plan to validate a specific PVA approach or independently estimate MVP size for tule elk (or any other elk in California); costs and monitoring are unwarranted and prohibitive. Nonetheless, PVA is an important conservation tool and can help identify and prioritize conservation actions, thereby providing insight into how resource management activities might affect the probability of extinction (Boyce 1992).

Long-term viability of California's endemic tule elk is of particular concern because of their precipitous decline in the 1870s and the persistent development/fragmentation of the state's rural landscape. In regards to MVP size, for the immediate future the Department intends to maintain at least 5,000 tule elk statewide, with at least 100 individuals in each unconfined EMU. The Department can modify these MVP thresholds as advances in PVA occur and techniques to determine MVP size improve. Statewide tule elk numbers have increased significantly since 1970 (Figure 2), and should continue to increase for the immediate future. Maintaining long-term viability of California's elk herds requires sustaining both individual herd numbers and genetic diversity. If there is minimal or no movement of individuals between herds they can become genetically isolated (Franklin 1980, O'Brien et al. 1985, Partridge and Bruford 1994). Changes in the numbers of individuals within each herd are a function of their respective birth and death rates, free movement between herds, and rates of emigration and immigration. Existing tule elk herds were established with small numbers of animals from the historically genetically limited population. Limited genetic diversity can threaten the long-term viability of small populations, either through increased susceptibility to disease, development of genetic defects, or a general limited ability to adapt to changing environments (O'Brien et al. 1985, Partridge and Bruford 1994). Individual herd viability is discussed further within their corresponding EMUs.

Maintaining or increasing genetic interchange between isolated elk populations is a management plan objective (Objective 1.4). The Department will periodically and opportunistically translocate small groups of elk to enhance the genetic diversity of geographically isolated populations. Additionally, potential movement corridors between established EMUs will be identified and protected. The Department is currently working with researchers to examine the genetic diversity of all three elk subspecies. Enhancing genetic diversity and maintaining or increasing connectivity between current and future habitat can help build resilience to climate change (National Fish, Wildlife, and Plants Climate Adaptation Partnership 2012, and California Natural Resources Agency 2014).

D. Disease Surveillance

Diseases and parasites are most likely not major contributors to elk mortality and few parasites have been documented in studies completed in California (California Department of Fish and Wildlife, unpublished data 2014). In the past, there have been a few instances where disease played a large role. There was at least one outbreak in the 1960s of what was suspected to be anthrax in the Owens Valley during which some elk were lost (McCullough 1969). However, due to the state of decay of the carcasses, the disease organism could not be isolated. In the PRNS herd, Johne's disease has been positively identified and several animals from this herd have died of the disease (Jessup

et al. 1981). Johne's disease is caused by the bacterium *Mycobacterium paratuberculosis* and is a chronic debilitating infection of both domestic and wild ruminants. In cattle, it may cause significant economic loss due to reduced milk production, loss of body condition, and mortality (Thorne et al. 2002). The prevalence of Johne's disease in tule elk at PRNS is unknown, however recent monitoring by PRNS staff confirms that Johne's disease is still present (D. Press, Point Reyes National Seashore, personal communication 2017). Elk game farms have been identified as a potential disease source in other states; California has no elk in game farms as this is a prohibited activity in the state (FGC §2118.2).

In 2010, an exotic louse (*Damalinia sp.*) was detected on tule elk and black-tailed deer at PRNS in Marin County. The deer and elk exhibited rough, dull coats and hair loss (alopecia). In 2013, exotic lice were found during testing in the Lake Pillsbury tule elk herd in Lake County. Samples were taken and sent to the National Veterinary Services Laboratory in Ames, Iowa for identification and were identified as *Damalinia cervicola*. The effect of exotic lice on elk populations is not known at this time.

Chronic wasting disease (CWD) is a contagious and fatal disease that affects nervous systems of elk, white-tailed deer, mule deer, and moose. CWD appears to develop when an abnormal prion protein accumulates in nerve tissue causing swiss-cheese-like holes in the brain. Primary symptoms of affected individuals include emaciation, lack of coordination, and excessive salivation (Davidson and Nettles 1997). Research suggests that CWD prions excreted in the feces or other bodily fluids of infected animals provide a mechanism for transmission (Tamgüney et al. 2009).

Another disease of concern is brucellosis, which is caused by the bacteria *Brucella*. Two species of *Brucella* cause the most concern in the United States: *B. abortus*, principally affecting cattle, bison, and cervids; *B. suis*, principally affecting swine and reindeer but also cattle and bison (Thorne et al. 2002). Brucellosis is a contagious bacterial disease that affects free-ranging elk and causes cow elk to lose their first calf after infection (Thorne et al. 2002). Although the risk for transmission is perceived to be very low, brucellosis is a threat to livestock and could affect the ability of cattle producers to market cattle if transmission occurs between elk and livestock. *B. abortus* is known to occur only in free-ranging elk of the Greater Yellowstone Area of Wyoming, Montana, and Idaho (McCorquodale and DiGiacomo 1985, Davis 1990). Reintroduction of the disease into a brucellosis-free state could have an economic impact on domestic livestock markets (USDA 2014).

Elk are susceptible to a variety of diseases, and to remain vigilant the Department will continue to routinely test animals captured during research projects, hunter harvested animals, and as other opportunities arise. California has monitored for CWD in deer and elk since the mid-1990s, and has established regulations to restrict parts of deer and elk carcasses brought into the state (Title 14, California Code of Regulations [T14, CCR, §712]). In addition to opportunistic testing, the Department collects blood and other samples from elk caught for translocation or for ungulate research projects within the state; these are useful for surveillance of brucellosis and other pathogen/parasites. No cases of CWD or brucellosis have been detected in elk in California to date.

E. Co-Management with California Federally Recognized Tribes & Tribal Traditional Uses and Knowledge

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes. The Department anticipates addressing many of these elk management issues with interested Tribes within the framework of specific EMUs through co-management agreements, memoranda of agreement, or similar mechanisms

The foundation of tribal management is a collective storehouse of knowledge about the natural world, acquired through direct experience and contact with the environment and gained through many generations of learning passed down by elders about practical, as well as spiritual practices (Anderson 2005). This knowledge is the product of keen observation, patience, experimentation, and long-term relationships with the resources (Anderson 2005). The Department and the USFS in the 2007 KNF Elk Management Strategy, acknowledge the importance of tribal management practices in creating and maintaining favorable elk habitat, including the use of fire. In addition to the wide-ranging ecological benefits of managing seasonal elk habitat needs at different elevation bands across the landscape, elk play important roles in many California tribal communities.

Elk have long served in many facets of tribal existence both as a dietary staple and in the manufacture of useful items that assisted in the hunt, in ceremony and in everyday life. For example, given their large size, elk bone was often carved into tools such as hide scrapers, etc., and the stomach casing was utilized as a bag in which to boil liquids. The large antler served to make fine “purses” (for dentalium), arrow points, chisels and wedges, and were carved into decorative spoons. Additionally, elk hide was used in the creation of clothing for ceremony and for everyday wear. Today, elk continue to serve as an important resource to many different Tribes and their members. Elk meat is commonly served at cultural functions and is often requested by tribal elders as the “dish of choice.”

Recent studies have linked loss of access to traditional foods with high rates of diet related illnesses, diabetes and heart disease among tribal communities. Tribes are concerned about the link between the loss of elk and declining health, a break in traditional use, the loss of cultural aspects of tribal society, and the ecosystem effect on the landscape. Tribes see managing and harvesting elk for subsistence purposes as an important step towards expanding access to cultural foods and reestablishing traditional food management and distribution. Elk are a critical component of local food sheds and elk meat can be an important component of a healthy diet.

Tribes have begun developing strategic initiatives for management of elk habitat that also accomplish management objectives related to other cultural foods, fibers and resources. This includes foods such as tan-oak acorns, matsutake mushrooms, huckleberry and salmon. Tribes have also identified a need to manage resources on a landscape-bioregional scale through seasonally rotating applications of cultural fire according to species' seasonal habitat as an important step in advancing current resource management. Reinstating elk habitat and herd management has far ranging implications for Tribes related to social and environmental justice concerns. These concerns include restoring local ecosystems and watersheds, expanding access to cultural foods and fibers, supporting local subsistence economies and community health, revitalizing cultural and ceremonial practices and enhancing self-governance and tribal sovereignty (Sarna and Tucker 2016).

F. Hunting

Hunting for elk currently occurs through the Department's Big Game (public) Drawing, the Private Lands Management (PLM) program, Cooperative Elk Hunting (T14, CCR, §555), tribal harvest, and in cooperation with the U.S. Department of Defense (T14, CCR, §640). The PLM program issues tags to cooperating landowner/operators to distribute or market at their discretion (thus providing landowners with an economic incentive to accommodate elk and/or tolerate some level of conflict with elk). Although this allows elk harvest on private property and manages elk population levels for some herds, PLM tags can be extremely expensive or otherwise unavailable to sportsmen and women.

The Department's Shared Habitat Alliance for Recreational Enhancement (SHARE) Program could meet the high demand for elk tags and provide some level of elk harvest on private property. Under the SHARE program, participating landowners receive monetary compensation and liability protection in exchange for allowing access to or through their land for public recreational use and enjoyment of wildlife. SHARE is funded through permit application fees. The program is relatively new and has provided limited public hunting opportunities for deer, wild pig, waterfowl, and elk. The SHARE program could expand to provide additional opportunities to sportsmen and women, as well as economic incentives to landowner participants.

G. Depredation Response and Alleviation

The growth in elk populations and expansion of range has resulted in increasing agricultural/private property complaints in areas with high concentrations of elk, such as northern California and the coastal range of central California. In some areas, the damage is chronic and not related to total numbers of elk, but to location and situation. The Department's protocol is guided by statute in FGC §4181. Specifically, elk depredation provisions require the Department to document damage, provide a written summary of corrective measures, and determine minimum viability of the herd.

The Department responds to reported game damage situations as promptly as feasible. The Department initially gathers information about the type of damage, characteristics of the property, and any previous history of depredation issues. Then the Department works with the landowner to identify and implement appropriate techniques to alleviate damage. Some techniques to alleviate elk depredation appear in Appendix C.

Issuing depredation permits can effectively resolve some conflicts when readily identifiable individual animals cause property damage. When depredation becomes chronic and/or large-scale problems occur involving numerous elk, the Department will emphasize regulated hunting and co-management with Tribes (when feasible) to alleviate conflicts. Through the Cooperative Elk Hunting and the SHARE programs previously discussed, landowners experiencing depredation conflicts within established public elk hunt zones can partially offset economic losses by charging a hunting access fee. Depredation permits can be issued as a technique when hunting and/or other methods do not adequately alleviate damage conflicts.

For instances where hunting programs are unfeasible, the Department can work with landowners to implement non-lethal techniques such as fencing and hazing to alleviate long-term depredation conflicts. In many situations, the greatest reduction and prevention of damage may be accomplished using multiple damage control techniques. Using a single technique by itself generally does not resolve chronic elk depredation problems. If those conditions leading to depredation are not changed or elk are not excluded through long-term techniques (such as fencing) then damage is likely to continue or resume at some point in the future.

As elk and human populations continue to grow, it is likely that depredation conflicts will continue or escalate, requiring development of additional innovative techniques. One such technique used in other states (such as Oregon) is implementation of depredation hunts. The feasibility of implementing surplus game hunts (as specified in FGC §325) is an alternative if other methods prove unsuccessful.

H. Human Dimensions

Traditionally, wildlife conservation and management focused on balancing the needs of wildlife and habitats; however, contemporary definitions include the incorporation of the human dimensions. On a basic level, the human dimensions approach can be described in two parts. The first highlights gathering reliable information that explains human beliefs and action regarding wildlife using the concepts and methods of social science. The second part is determining how to use that information in making management decisions. Social information is just one consideration among many (e.g., biological, legal, political) in the decision-making process (Manfredo et al. 1995). Human dimensions offers promise in efforts to make decisions that are more responsive to the public and that, in the long term, increase the effectiveness of decision-making (Decker et al. 1989, 1992). Effective wildlife conservation and management can be thought of as successfully integrating the needs of three inter-playing dimensions comprised of humans, wildlife, and habitats, with the environment in which they operate. Everything in a wildlife management system that is not wildlife or habitats is about humans, and

humans have the greatest level of impact on wildlife and habitats. Most concerns about wildlife populations and/or habitats have direct or indirect human dimensions consideration as either the cause of, or the cure for problems. Effective wildlife management and conservation works to discover, understand and apply insights about how humans value wildlife, how humans want wildlife to be managed, and how humans affect or are affected by wildlife and wildlife management decisions. Collectively, these are known as the human dimensions of wildlife (Decker et al. 2012).

The intent of this section is to highlight the importance of incorporating an understanding of human dimensions into management decisions. Fundamental to incorporating the human dimensions of wildlife into management decisions is to build an understanding of decisions' potential impacts to stakeholders (individuals or groups who may be affected or who can affect wildlife management decisions and programs). Impacts, as used here, are defined as the effects of human-wildlife interactions resulting in strong stakeholder interest and management attention (Riley et al. 2002). Impacts can be either positive or negative and take many forms (e.g., economic benefits or costs; ecological services wildlife provide; physical, mental or social benefits provided by consumptive or nonconsumptive use of wildlife) (Decker et al. 2012).

III. UNRESOLVED MANAGEMENT ISSUES AND INFORMATION NEEDS

A. Key Uncertainties

The following challenges currently, or potentially, affect elk populations and require conservation action now, or may require future conservation action to address their impacts:

- Habitat Loss/Change

Human actions can displace elk from habitat where they would otherwise obtain nutrients or other resources (e.g., watering, foraging, or calving habitat). The result of such displacement is a reduction in carrying capacity or potential loss of subgroups of elk due to lack of available habitat or movement between habitats. Changes in habitat can be equivalent to habitat loss. In addition, successional changes in vegetation communities from early to later seral stages are a concern for conifer and shrub dominated landscapes. Invasive species in grass/forb communities such as cheatgrass, medusahead, and other nonnatives are a concern for habitat quality and availability. Climate change may exacerbate some of these issues, including the spread of invasive species and habitat/vegetation conversion (Bradley et al. 2016).

- Parasites

Detection of exotic lice at PRNS (Marin County) and Lake Pillsbury (Lake County) constitutes a potential adverse impact relative to California's elk. Further investigations to determine prevalence and potential impacts to elk populations are a priority.

- Predation

Impacts of predation on California elk population dynamics are poorly understood. In California, mountain lions are believed to be the primary predator on adult elk. In addition, black bears and coyotes will prey on elk calves. However, gray wolves have recently (2014) arrived in northern California. The best available scientific information suggests that wolves preferentially prey on elk populations when present and on deer in the absence of elk. Because of this, there is concern that wolves alone or in combination with other predators could significantly affect elk populations and possibly extirpate local populations of elk. .

Prey selection by wolves in California will most likely consist of Roosevelt elk and blacktailed deer in the northwestern part of the state, and Rocky Mountain elk and mule deer in northeastern California. In California, elk distribution is patchy throughout their range, with large areas of unoccupied suitable habitat. This includes the small groups or subpopulations of Rocky Mountain and Roosevelt elk that have become established since the 1980s and have been slowly increasing and expanding within their historical range. Tule elk, which occur further south, could become vulnerable to predation due to their small scattered herds if wolves were to move significantly further south and inhabit tule elk range.

The Conservation Plan for Gray Wolves in California Part II (Kovacs et al. 2016) references strategies to achieve plan goals. Several of the identified strategies directly relate to elk (Strategies 3, 7, and 9). These strategies include: protecting and managing habitat and ungulate populations to provide abundant prey for wolves and other predators;conducting scientifically-based surveys of California's diverse public to gather information about public knowledge and attitudes about wolves and ungulates; and coordinating with public land agencies (i.e. USFS, BLM, NPS, USFWS), landowners, and NGOs to help achieve conservation goals and objectives.

California's low numbers of elk compared to other western states, patchy distribution, and the long-term declining trend in the deer population, causes some concern about the anticipated impact from wolves. The Department and the Wolf Stakeholder Working Group identified an initial set of thresholds which when met, would initiate management responses to the extent that management actions are available. Initially, the following thresholds (presumed to be influenced by wolf predation) will indicate significant impacts to ungulate populations and trigger management considerations by the Department:

- Reduction in survival of adult females below 80% for elk, or
- 25% or more population reduction in elk herds in a three-year monitoring period, or
- Elk calf:cow ratios fall below 20:100 in a three-year monitoring period, or
- Reduction of allocated big game tags to below current levels in areas occupied by wolves.

For a given EMU, surpassing these thresholds may indicate a declining population and management actions may be needed once the cause of the decline is determined. If the Department detects a negative impact on elk within an EMU, focused discussions of causes and feasible solutions to reduce the impact will be needed. Options will include improving habitat conditions and managing specific causes of ungulate, especially elk, mortality. If poor ungulate habitat conditions are identified, actions by the Department may be limited if impacts are occurring on lands managed by other public land agencies and or under private ownership. The Department will coordinate with these public and private landowners to address habitat conditions in need of improvement.

- Hunting Tag Distribution

Elk hunt tags are in high demand in California, with over 36,000 applicants for the 320 general draw elk tags issued in 2016. Additionally, the 2010 Final Environmental Document on elk hunting (California Department of Fish and Game 2010) states not more than 100 antlerless and 139 bull elk would be removed under the PLM program. In 2016, 67 antlerless and 94 bull elk were harvested through the PLM program. Allocation of tags through the general draw system in comparison to those issued through the PLM program is a concern to many sportspersons in California. The Department recommends that the number of PLM tags issued should not exceed 50% of the tags issued through the general draw (including SHARE elk tags and PLM tags donated to SHARE for the general public). This recommendation is an effort to meet both the demands of the general hunter and PLM operators. Implementing this recommendation would require a change to Title14, CCR.

- Climate Change

Changes in climate and associated changes in vegetative communities and wildlife habitats will be determining factors regarding the future distribution and abundance of elk in California. Although research specific to elk responses to climate change is limited, what information does exist indicates that both adverse and beneficial effects, depending on a variety of local/regional factors such as latitude, elevation, topography, and aspect, will result. For example, in the Rocky Mountain National Park where snow accumulation currently limits elk winter range, computer simulations suggest a reduction in future snow accumulations of up to 25-40% (Wang et al. 2002). Warmer temperatures affect vegetation biomass and elk can respond positively to this vegetation increase. Simulation results suggest that there could be more elk in a warmer climate, because when in better body condition elk reproduce earlier and survive longer (Wang et al. 2002). In addition, an expansion of winter range would serve to increase over-winter survival and recruitment of juveniles into the adult population, leading to an increase of the overall elk population in that area (Hobbs et al. 2006). Conversely, research in Banff National Park, Canada indicates climate change will result in colder winter temperatures, increased snowfall, and a higher frequency of winter storms (Hebblewhite 2005). These factors would result in a decrease in over-winter survival and recruitment, leading to an overall reduction of the elk population for that area. Most of the elk range in California consists of snow free areas. Portions of the Marble Mountains EMU (Siskiyou and Trinity counties) contain elk range at higher

elevations impacted by snow for a portion of the year. These areas may see responses similar to those reported by Wang et al. (2002), and Hobbs et al. (2006).

How much of a role climate change plays in California precipitation is difficult to answer. Killiam et al. (2014) indicates that warming may be leading to rising precipitation trends in the northern portions of California and a reduction in the southern portions. In general, climate changes are shifting the suitable range for many plant species to the north and to higher elevations. Snow accumulation levels and ambient temperatures could alter spring conditions, which may impact ungulates (Moser et al. 2009, Mysterud 2013).

As previously stated, elk occupy a wide variety of habitat types. Many EMUs contain vegetative communities believed to have low or moderate vulnerability to climate change; however, the Northeastern EMU contains several highly vulnerable vegetation types. Subalpine Aspen Forests and Pine Woodland, Great Basin Dwarf Sagebrush Scrub, and Great Basin Upland Scrub have all been identified as highly vulnerable to climate change (Thorne et al. 2016), which may negatively impact the corresponding Rocky Mountain elk population as habitat quality declines. Vulnerability is based on a combination of estimates of each vegetation community's sensitivity to climatic change, adaptive capacity, exposure to projected climatic changes, and expected shifts in extent.

Climate influences to elk in California are difficult to forecast because of the wide distribution and variety of habitats utilized by elk. Generally speaking (and independent of other stressors) a wide distribution, reliance on a variety of habitat types, good dispersal ability, and opportunistic feeding habits suggest that the elk may be more resilient to the impacts of climate change than other native species in the state. In some cases, elk may benefit from climate change, but population monitoring, as suggested throughout this plan, will be important to ensure that any adverse effects of climate change are detected (Inkley et al. 2013).

B. Research Needs to Inform Management

- Population Monitoring

Reliable estimates for populations of animals such as elk are needed for assessing their status (Klein 1972), understanding factors related to their persistence (Berger 1990), and developing strategies for their conservation (Bleich et al. 1990). Ground, helicopter, and fixed-wing surveys have been the primary techniques used to collect data for ungulates (Lovaas et al. 1966, DeYoung 1985, Beasom, et al. 1986, Ericsson and Wallin 1999). Each technique used includes biases that potentially affect survey results (Caughley 1974, McCullough et al. 1994). For example, results obtained from simultaneous ground and aerial survey results can differ greatly for the same population of ungulates (Gilbert and Grieb 1957, Caughly 1974, Samuel et al. 1987). Determining the most appropriate survey technique for an individual EMU is needed for reliability, repeatability, and the efficient use of limited resources. Helicopter surveys are typically preferred over fixed-wing or ground surveys (Hess 1997, Smith and Anderson 1998).

Reasons for this include an enhanced ability to obtain larger sample sizes, identify and classify a larger proportion of animals that are encountered, and survey broad geographic areas that include a variety of habitats (e.g., surveys are not limited to areas near roads). Not all elk ranges lend themselves to helicopter surveys, however, and other methods must be evaluated and used.

The Department recognizes that monitoring elk populations is a difficult task and requires cooperation among agencies and Tribes. The Department is committed to cooperate with Tribes to monitor elk populations in a continuing effort of co-management. Monitoring California elk populations in recent years has been accomplished through a combination of aerial and road surveys conducted at various times of the year. Timing of surveys is designed to coincide with the fall leaf drop in areas with deciduous trees, thus increasing observability of elk. Fixed-wing surveys have been used in open environments with high visibility, such as portions of Inyo, Merced, and San Luis Obispo counties. These areas lack extensive canopy closure and topographic relief, which increases the visibility of elk groups to observers. In 2008, the Department flew a helicopter survey for the San Luis Reservoir area (Merced County), then repeated the survey two days later with a fixed-wing aircraft, with very similar results. These types of open areas lend themselves to use of fixed-winged surveys in place of the more expensive helicopter. Road surveys are used in areas with established roads in open habitat with limited obstruction from topography and/or vegetation.

The Department is evaluating large mammal survey techniques and the suitability of resulting data. Every technique has advantages and disadvantages. Helicopter surveys are expensive and costs are expected to increase in the future; this technique is also dangerous, as evidenced by fatalities of biologists nationwide from accidents. It is not clear that one specific technique should be used for every EMU in California. A variety of techniques should be used based on the data desired, costs, geographic location, habitat/vegetation cover, and other factors.

DNA extracted from elk droppings is used to identify individual elk and determine gender (Lukacs and Burnham 2005, Brinkman and Hundertmark 2009, Brinkman et al. 2011). The recent development of fecal-genetic capture-mark-recapture (CMR) methods has increased the feasibility of estimating abundance of forest-dwelling ungulates, such as elk, that can be difficult to survey using visual methods. Aerial surveys are less feasible in forested habitats where trees decrease visibility, such as those habitats occupied by many of the Roosevelt and Rocky Mountain elk. Initial identification of DNA is a “capture” and subsequent identification of the same individual is a “recapture”. This CMR allows a statistical estimate to be calculated (Lounsberry et al. 2015). In addition, the genotypic information obtained is also used to evaluate genetic diversity, which is a concern for some herds of tule elk (Waits and Paetkau 2005, Yoshizaki 2007). The Department initiated a study to use this technique in Merced County during 2015 and is currently developing similar studies for portions of Colusa, Glenn, Lake, Del Norte, and Humboldt Counties.

Unmanned aerial vehicles (UAVs) technology is one of the new perspectives for wildlife surveys (Lhoest et al. 2015). UAVs offer a safer way for scientists to observe their subjects in a cost effective and precise manner. Safety is of concern when conducting low-level wildlife surveys. The Department has been active in pursuing UAV technology and its potential use in ungulate surveys. In 2014 the Department partnered with the USFWS and the United States Geological Survey (USGS) to assess the value of UAVs as an efficient means for detailed reconnaissance and verification of elk distribution and population assessment within known use areas within and adjacent to the Carrizo Plains Ecological Reserve, San Luis Obispo County. Additionally, a secondary purpose was to evaluate the utility of UAV to assess and validate existing vegetation mapping efforts. The UAV team successfully collected imagery, video, and elevation data for elk herds and vegetation within the areas of interest. The UAV team identified limitations of UAV use compared to use of a traditional helicopter. The area surveyed utilizing the UAV is vastly smaller than the area surveyed utilizing a helicopter during the same period. The Department recognizes that UAV technology is constantly growing and that current and future UAV technology has the potential to overcome some of the shortfalls encountered with the test in San Luis Obispo County, and is continuing to pursue the use of UAVs to survey for elk and other ungulates.

- Species Distribution

All three elk subspecies are believed to be expanding their distribution and abundance within California. However, due to the rugged terrain and low visibility habitat where Roosevelt elk occur, their distribution is not completely known (Lowell 2010, California Department of Fish and Wildlife, unpublished data 2016). Research conducted with additional satellite telemetry collars would assist the Department in acquiring information on both distribution and connectivity between populations of elk and may ultimately assist to determine if any range shifts are occurring as a result of climate change.

Sightings of elk outside of existing known range are reported to the Department on a regular basis (California Department of Fish and Wildlife, unpublished data 2014). These reports originate from the general public, other governmental employees, and Department employees. Most of these reports are believed to be Roosevelt or Rocky Mountain elk due to the locations reported. Identifying and documenting these range expansions is needed to fully understand dispersal mechanisms, habitat corridors, and full distribution of elk in California.

- Distribution of Elk on California Tribal lands

The three subspecies of elk found within California are distributed across the landscape over numerous land ownerships including, USFS, BLM, National and State Parks, private, and tribal. A variety of lands and associated habitats owned and managed by Tribes throughout California encompass historical and current elk range. A Tribe may hold the lands in fee title or be a beneficiary of lands held in trust for the Tribe by the United States. In addition, the United States owns land held in trust for individual tribal members. These tribal lands may be within a Tribe’s reservation or rancheria, or outside

of them. The amount of tribal lands for an individual Tribe in California varies from a few or no acres to approximately 90,000 acres. Elk persist on tribal lands in varying degrees throughout California and Tribes have expressed interest in re-introducing elk on tribal lands within historical elk range.

- Connectivity/Fragmentation

The Department needs to identify and maintain movement corridors for elk that are suitable currently and under a range of possible future conditions to prevent potential barriers and maintain/enhance genetic diversity. Loss of landscape connectivity and the fragmentation of habitats are major threats to the biodiversity of plant and animal life in California (Spencer et al. 2010, Theobald, et al. 2011, Lacher and Wilkerson 2013). Large mammals such as elk require large interconnected regions for maintaining the genetic diversity of healthy populations (Kucera 1991, Lyon and Christensen 2002, Williams et al. 2004, Cronin et al. 2008). Maintaining landscape connectivity for tule elk continues to be a major concern because population numbers were so dramatically reduced by the 1870s (Kucera 1991, Williams et al. 2004).

- Forage/Habitat

A better understanding of habitat utilization and availability is needed to make informed management decisions in coordination with state and federal land agencies and private landowners. In California, forage conditions across all three subspecies of elk ranges are the result of precipitation, range and forest management, and livestock grazing. Yearly differences in precipitation and plant growth alter elk foraging behavior (Picton 1960, Mackie 1970). The quantity and nutritional quality of preferred forage species may fluctuate due to disturbance history and the stage of forest succession. The successional state of the habitat type along with disturbances such as fire and logging may alter both quantity and nutritional quality of available elk forage species (Lyon et al. 1978, Schroer et al. 1993, Skovlin et al 2002, Wisdom et al 2004). A limited number of habitat or forage utilization studies have been implemented in California, especially considering the diversity of habitat types that are occupied by elk across the state (Harn 1958, Bentley 1959, Phillips et al. 1982, McCoy 1986, Fischer 1987, O'Connor 1988, Kitchen and Woodard 1996, Klamath National Forest 2007).

IV. MANAGEMENT ACTIONS

A. Strategy for Implementation and Evaluation

All management actions and the evaluation of their success will be based on statistically valid population sampling methods and population estimates when feasible. Design and establishment of consistent, repeatable survey techniques including aerial, ground, and alternative methods still under development will provide statistically valid data to guide future management actions.

B. Priority Actions

1. Survey/Monitoring Actions

Monitoring actions involve developing and implementing surveys to estimate population parameters over time. These will utilize a variety of methods including helicopter surveys, fixed-wing surveys, ground counts, genetic analysis of tissue/fecal samples, and photographic surveys as appropriate.

Habitat-use will also be monitored using global positioning system (GPS) collared elk in order to track distribution and movement across habitat types. Individual herds will also be monitored through GPS collars to identify dispersal and movement of elk in an effort to identify isolated subherds.

2. Habitat Conservation Actions

Habitat-use information from GPS monitoring will provide data to evaluate potential habitat improvement/development projects and proposed land management actions within elk range. Habitat use information is necessary to help identify desirable elk habitats and assess connectivity between and within EMUs so that movement corridors can be protected and new corridors can be identified.

3. Public Use Actions

The Department will continue to take advantage of opportunities to inform the public about the recovery of elk in California, and promote various recreational opportunities such as viewing, photography and nature study. The elk hunting program will continue in accordance with FGC §332. Expanding, modifying, or adding hunt zones will be evaluated based on the following criteria:

- Consistency with population and management objectives of the respective EMU document (Appendix E);

- Adequate population monitoring has been conducted to support the management action. Specifically, monitoring must produce demographic data that indicate a population of sufficient size and stability to support hunting and allow the Department to determine the effects of a limited hunting program.

The Department intends to prepare additional EMU documents if elk distribution expands beyond the EMU areas depicted in Figure 7, or if population levels significantly increase (above established objectives) within an established EMU. It is expected that a revised/additional EMU document would be added to Appendix E of this document; and, that appropriate compliance with California Environmental Quality Act provisions would occur prior to implementation of any new hunts.

Allocating tag proportions through the general drawing and PLM programs is, as of yet unresolved. The Department has recommended that the number of PLM tags not

exceed 50% of the general draw tags (see Chapter III). This would require a formal regulatory amendment and adoption by the Fish and Game Commission.

4. Co-Management with California Tribes

The Department, as stated in its Tribal Communication and Consultation Policy, seeks and encourages collaborative relationship with Tribes, including for the co-management of resources. The Department anticipates working with individual Tribes to develop co-management agreements, memoranda of agreement or similar mechanisms to establish positive, cooperative relationships with Tribes for the management of elk across the landscape.

Tribes have expressed interest in working with the Department to address overall elk management and location-specific management issues within the EMUs. The Department will work with Tribes to develop a collaborative process for determining elk populations, herd viability, ecological carrying capacity, harvest strategies, on-going monitoring, and adaptive management, and to refine elk management at the EMU level.

V. PLAN REVIEW AND REVISION

Progress in achieving actions called for in this plan should be reviewed annually, and this plan should be updated within 5 years of approval, or sooner, if needed. If the plan is considered appropriate and adequate, a new set of management unit goals should be developed and reviewed on a 10-year basis. The Department will revise the plan as necessary to reflect new information, new factors affecting elk or elk management, or the development of new techniques that enhance the conservation of elk in California.

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VII. GLOSSARY OF ACRONYMS AND TERMS

BG - Big Game
BGMA - Big Game Management Account
BLM - Bureau of Land Management
BMP - Best Management Practice
BOR - Bureau of Reclamation
CalTrans - California Department of Transportation
CBEC - Crescent Beach Education Center
CSBOE - California State Board of Equalization
CCR - California Code of Regulations
CDFG - California Department of Fish and Game
CDFW - California Department of Fish and Wildlife
CDPR - California Department of Parks and Recreation
CMR - Capture-Mark-Recapture
CWD - Chronic Wasting Disease
CNWS - Concord Naval Weapons Station
Department - Department of Fish and Wildlife
DFG - California Department of Fish and Game
DFW - California Department of Fish and Wildlife
DNA - Deoxyribonucleic Acid
DWP - Los Angeles Department of Water and Power-
DWR - Division of Wildlife Resources (Utah)
EMU - Elk Management Unit
FGC - Fish and Game Code
FHL - Fort Hunter Liggett
GPS - Global Positioning System
GS - Game Species
HSU - Humboldt State University
KNF - Klamath National Forest
LRMP - Land and Resource Management Plan
MIS - Management Indicator Species
MSY - Maximum Sustained Yield
MVP - Minimum Viable Population
NGOs - Non-governmental Organizations
NPS - United States National Park Service
NRCS - Natural Resources Conservation Service
ORV - Off Road Vehicle
PLM - Private Lands Management
PR - Pittman-Robertson
PRNS - Point Reyes National Seashore
PVA - Population Viability Analysis
RMEF - Rocky Mountain Elk Foundation
RNP - Redwood National Park
RNSP - Redwood National and State Parks
SFWD - San Francisco Water Department

SHARE - Shared Habitat Alliance for Recreational Enhancement
SRCD - Suisun Resource Conservation District
T14 - Title 14 (California Code of Regulations)
Tribes - California Federally Recognized Tribes
UAV - Unmanned Aerial Vehicle
USDA - United States Department of Agriculture
USFS - United States Forest Service
USFWS - United States Fish and Wildlife Service
USGS - United States Geological Survey
YNP - Yellowstone National Park

VIII. APPENDICES

Appendix A: Hyperlinks to Select Sections of Fish and Game Code Pertaining to Wildlife Management and Elk (organized sequentially):

§325. Surplus Game Hunting Season; Establishment of

§332. Elk tag; Fee

§1801. Declaration of Policy

§1802. Jurisdiction of Department

§2118.2. Importation of elk into the state

§2118.3. Removal of horn or antler from live elk prohibited

§2118.4. Seizure of imported elk

§3952. Statewide elk management plan

§3953. Big Game Management Account; Use of Funds

§4181. Permit to kill animals damaging or destroying land or property; Sale or shipment of animals; Traps; Permit for taking bears; Information on options for wild pig control; Procedures regarding elk

§12300. Application of Code; Prosecution

Appendix B: Hyperlinks to Select Sections of the California Code of Regulations Title 14. Natural Resources.

§555. Cooperative Elk Hunting Areas.

§640. Management of Fish and Wildlife on Military Lands.

§712. Restriction of Importation of Hunter-Harvested Deer and Elk Carcasses.

Appendix C: Depredation Response Techniques.

1. **Dispersal/Hazing.** Dispersal through the use of noise makers and repellants, or other activities agreed upon which would serve to haze animals away from an area is one technique used to alleviate depredation. Scare devices such as cracker shells and propane cannons to harass animals away from agricultural crops or areas experiencing depredation are usually effective for a short period of time. Hazing is sometimes a preferred option when quick action is needed in high value crops. Propane exploders can prevent elk from using sites for several weeks, after which the elk may lose interest and go elsewhere. Generally, one exploder will protect 5 to 10 acres (2 to 4 ha). Exploders are most effective when their locations are changed every few days so that elk do not habituate to the sound pattern. Better results might be obtained by combining this method with other techniques such as active hazing (herding) and visual barriers. Exploders may be an unacceptable nuisance to nearby neighbors.

   A little used option for addressing elk damage is herding. This amounts to a structured hazing program. The drawback is that populations are not reduced unless hazing/herding is coupled with increased harvest. Elk may be temporarily hazed or frightened out of crop fields, orchards, and pastures by the use of people, vehicles, fixed-wing aircraft or helicopters, but these can be expensive and may have human safety risks associated them. Elk will most likely return without some type of long-term plan in place, especially if pastures are on traditional elk range.

2. **Physical Barriers**. Physical barriers such as fencing, mesh wire, panels, electric fence, and visual barriers (such as landscaping cloth hung between fence poles) can be used to limit or prevent access to areas from elk. Fencing of small parcels to protect individual crops and/or fields has been used to a limited degree. The cost of fencing can be high but if done properly can be an effective long-term solution. Fencing has provided relief from elk damage where plants cannot be protected individually, such as in hay and grain fields, hay stacks, large orchards, and pastures. Six to eight foot high woven wire fences, topped with two strands of smooth or barbed wire will prevent access. High-voltage (3,500- to 7,500- volt) electric fences have proven to be a relatively inexpensive and effective alternative to woven-wire fences. They feature 8 to 11 smooth strands of triple-galvanized, high-tensile steel wire supported by conventional fence post systems. Considerable expertise is required to construct these fences, but when built properly, they can provide nearly as much protection from damage as mesh fences. Researchers in Pennsylvania developed 4- to 5-strand electric fences that provided 80% or more protection from deer damage. In Oregon, an 8-foot (2.5-m) electric fence consisting of 11 wires successfully kept elk from entering a rhododendron nursery that previously had sustained persistent trampling damage. A key component of electric fences is the high-voltage charger or “energizer.” These are available as 110 volt or battery-operated units. For a fence to be effective, it must be visible to the elk. In the case of an electric fence,

which a herd can easily run through, it must be seen and associated with an electric shock. Erecting an electric fence in areas where elk move to after sunset will most likely end up being ineffective and damaged to some degree. Efforts should be made to make the fencing as visible as possible to the elk, such as placing light-colored surveyor tape on or near the fence. To help “initiate” elk to the shocking power of fences, place peanut butter on tinfoil strips and attach the strips to electric fence wires 3 feet (1 m) above ground.

For smaller orchards, individual trees can be protected with 6-foot (1.8-m) cylinders of welded wire. Protectors for individual coniferous and deciduous tree seedlings are effective until the leader (growing tip) or lateral branches grow out of the protectors and are once again exposed to elk browsing. Due to the high cost of many of these materials, some states have implemented cost-share programs wherein some or all of the cost of fencing materials may be borne by one or more agencies responsible for managing elk damage. The state of California is not one of these states, and has no mechanism or authority in place to authorize cost sharing in any form.

3. **Repellents.** Repellents may reduce elk damage in orchards, vineyards, and conifer plantations. Where frequent washing rains occur, some repellents must be applied more than once. Damage can be prevented without treating the entire area by applying odor repellents to plants within a 25-foot-wide (10-m) strip around field edges where most of the damage occurs. The Forest Service has a “20 to 80 percent” rule for determining whether repellents will be successful: If elk damage to conifers is less than 20%, application of the repellent will not pay for itself. If the damage is over 80%, the elk have become too habituated to feeding in the area and will not be deterred by the application of repellents. Little success is reported with repellents such as human hair, tankage, blood meal, or thiram. Successful repellents include formulations of fermented eggs (Big Game Repellent® or Deer-Away®) and hot sauce containing capsaicin.

4. **Population manipulation**. General hunting permits (elk tags) can be issued to reduce or stabilize local elk populations in an effort to alleviate depredation concerns while at the same time providing recreational hunting opportunities. In certain situations general elk tags may be enough to reduce the local elk population and alleviate depredation concerns. Elk or small groups of elk causing depredation may not be accessible to general elk tag holders or hunters may exacerbate the situation by pressuring the animals from public property onto properties already experiencing depredation.

   In situations where the issuance of general elk tags does not alleviate depredation and the Department determines additional reductions are necessary, special elk depredation hunts may be established to reduce the size of herds on private property causing damage. Hunters must have good access to areas for these hunts to be effective for herd reduction and/or elimination of problem animals.

Another form of population reduction is the translocation of problem animals. Capturing and translocating elk is a common procedure in several states as long as there are areas identified as being understocked with elk. Small numbers of elk (1 to 10) can be captured in large, baited corral traps. Free-ranging individual elk can be immobilized by projectiles fired from rifles to inject drugs, and helicopters can be used to net gun and secure elk. Costs of trapping and transporting elk are prohibitive and generally are not recommended.

5. **Deferred.** Under limited circumstances, elk may be “deferred” from damaging crops by planting other forages that elk prefer. Landowners develop “Green Forage” areas to draw animals away from damaging other areas. In these situations, preferred grasses or forbs are seeded and may be fertilized as well, depending on the site characteristics. The cost of these types of activities would fall to the landowner or the potential to cost share such activities with other agencies and organizations such as the Natural Resources Conservation Service (NRCS), USFWS, and RMEF. Food plots and salt blocks have been used on public lands adjacent to agricultural fields and pastures to reduce damage by resident and migratory elk. Food plots are maintained in an early successional state (grasses and forbs) by one or more techniques: seeding, mowing, fertilizing, burning, and/or spraying with herbicides. The expense of establishing and maintaining substantial acreages of high-quality food plots may limit their use.

Appendix D: Guidelines for the Construction of Elk Resistant Fencing

July 2015

Often the most effective long-term solution to elk damage problems is exclusion of the animals with a fence. As a general rule, fences built with sturdier materials and quality construction will be more effective, require less maintenance, and will last longer.

Woven Wire Fencing

These fences are initially expensive and difficult to construct, but when well-built are very easy to maintain and have a long lifespan. When properly built and maintained, they provide a high level of protection from elk.

- Woven-wire fences should be at least 8 feet tall. To protect high value crops, fences should be at least 10-12 feet tall. Fence height should be increased to accommodate topography and snow accumulation.

- The bottom of the fence should be at ground level. Fill dips with gravel, rocks, logs, or other suitable material.

- Brace posts should be wooden posts at least 5 inches in diameter and 12 feet in length. They should be sunk at least 4 feet into the ground. The fence should be securely braced at corners, angles, gates, and at intervals along longer sections. Bracing should be installed at least every 660 feet, but topography, quality of building materials, environmental conditions, and elk pressure may necessitate bracing at shorter intervals.

- Line posts should be wooden posts at least 4 inches in diameter and 12 feet in length. They should be sunk at least 3 feet into the ground and set about 15 feet apart.

- Wooden posts should be of good quality and treated with preservative for at least the length of post sunk into the ground plus one foot above ground level.

- Woven wire fence should be at least 12.5 gauge galvanized steel 20/96/12 knotted joint wire with 20 horizontal wires, 96-inch height, and 12-inch spaced vertical wires.

- Gates can be constructed in a number of ways and can be made of different materials as long as the height, tightness, and strength needed to exclude elk is maintained.

- Place gates at corners so that an accidentally trapped animal will be easier to herd out of the exclosure. Maintain on-hand at least 100 feet of high visibility temporary fencing (safety fence or plastic deer fence) and t-posts to install a drift wing at corner gates to aid in removing accidentally trapped animals.

- Increasing the visibility of the fence may reduce incursion into the exclosure. Visibility can be increased by hanging flagging from the fence.

- Additional information on corner bracing, stretching wire and other aspects of fence building can be obtained from suppliers of fencing materials.

Permanent Woven Wire Fence

Photo from BCMAFF 2001

Airport Chain-Link Security Fence

Electric Fencing

Permanent Electric Fence

These fences are easier to build than a permanent woven wire fence and are less expensive for fencing larger areas, but require additional maintenance. When properly built and maintained, they provide a high level of protection from elk.

- Permanent electric fences should be at least 8 feet tall. To protect high value crops, fences should be at least 10-12 feet tall. Fence height should be increased to accommodate topography and snow accumulation.

- Brace posts should be wooden posts at least 5 inches in diameter and 12 feet in length. They should be sunk at least 4 feet into the ground. The fence should be securely braced at corners, angles, gates, and at intervals along longer sections. Bracing should be installed at least every 660 feet, but topography, quality of building materials, environmental conditions, and elk pressure may necessitate bracing at shorter intervals.

- Line posts may be wood, steel, or fiberglass. The base of wood posts should be buried at least 3 feet into the ground. Steel posts should be at least 133-T type posts with at least 24 inches sunk into the ground. Fiberglass posts should be ultraviolet resistant and installed at least 24 inches into the ground. The distance between line posts should not exceed 30 feet.

- Wooden posts should be good quality and treated with preservative for at least the length of post sunk into the ground plus one foot above ground level.

- Wire should be at least 12.5 gauge Class III galvanized steel with a tensile strength of 200,000 PSI and breaking strength of 1,800 pounds.

- Wires should be spaced no more than 10 inches apart. The bottom wire should be 10 inches above the ground surface. All wires may be electrified; however, the fence should be constructed so wires two and four can be grounded when the earth becomes dry in the summer.

- The effectiveness of the fence may be improved by installing a strand of electrified wire suspended 2.5 feet out from the fence at a height of 3 feet above ground level.

- A high-quality, low-impedance energizer is essential for successful operation of the fence. Use a 110 volt charger, or if power is not available, a solar charger with 12-volt deep cell (marine) batteries may be used. Chargers should be UL approved. The charger should have a minimum stored energy of 0.7 joules and output of 5,000 volts (maintain at least 3,000 volts at the furthest distance from the charger). The pulse rate should be short (1/30,000 of a second or less) to minimize fire hazards and the chance of tissue damage.

- Ground the fence properly according to the energizer's instructions.

- Gates can be constructed in a number of ways and can be made of different materials as long as the height, tightness, and strength needed to exclude elk is maintained.

- Place gates at corners so than an accidentally trapped animal will be easier to herd out of the exclosure. Maintain on hand at least 100 feet of high visibility temporary fencing (safety fence or plastic deer fence) and t-posts for the installation of a drift wing at corner gates to aid in removing accidentally trapped animals.

- To train elk to avoid the shocking power of the fence, contact with the fence may be initiated by placing peanut butter on tinfoil strips attached to electric fence wires approximately 3 feet above ground.

- Install electric fence warning signs.

- Inspect the fence on a regular basis to verify it is charged, all components are intact, and adjacent vegetation is not encroaching on wires.

- Additional information on various aspects of building an electric fence is available from suppliers of fencing materials.

Permanent High Tensile Electric Fence

Photo from BCMAFF 2001

Temporary Electric Fence

Temporary electric fences are relatively inexpensive, but typically provide low to moderate protection. They are most effective when elk pressure is low and exclusion of elk is not critical. The fences utilize electric polywire or polytape and are easy to construct, do not require rigid corners, and the materials are readily available at hardware stores, feed stores, and home improvement centers. Temporary fencing should be installed at the first sign of damage to prevent elk from establishing a habitual feeding pattern in the area of concern. Regular inspection and maintenance are required to ensure that the fence remains in good working condition.

Modified Cattle Fencing

Existing cattle fencing may be modified to resist elk passage by installing electrified wires. This solution typically provides a lower level of protection than that offered by purpose built permanent fences. It is, however, a relatively inexpensive alternative when reliable cattle fencing is already in place. The specifications of the fence should follow those provided for permanent electric fences as closely as is feasible.

A Makeshift Fence Providing Moderate Protection

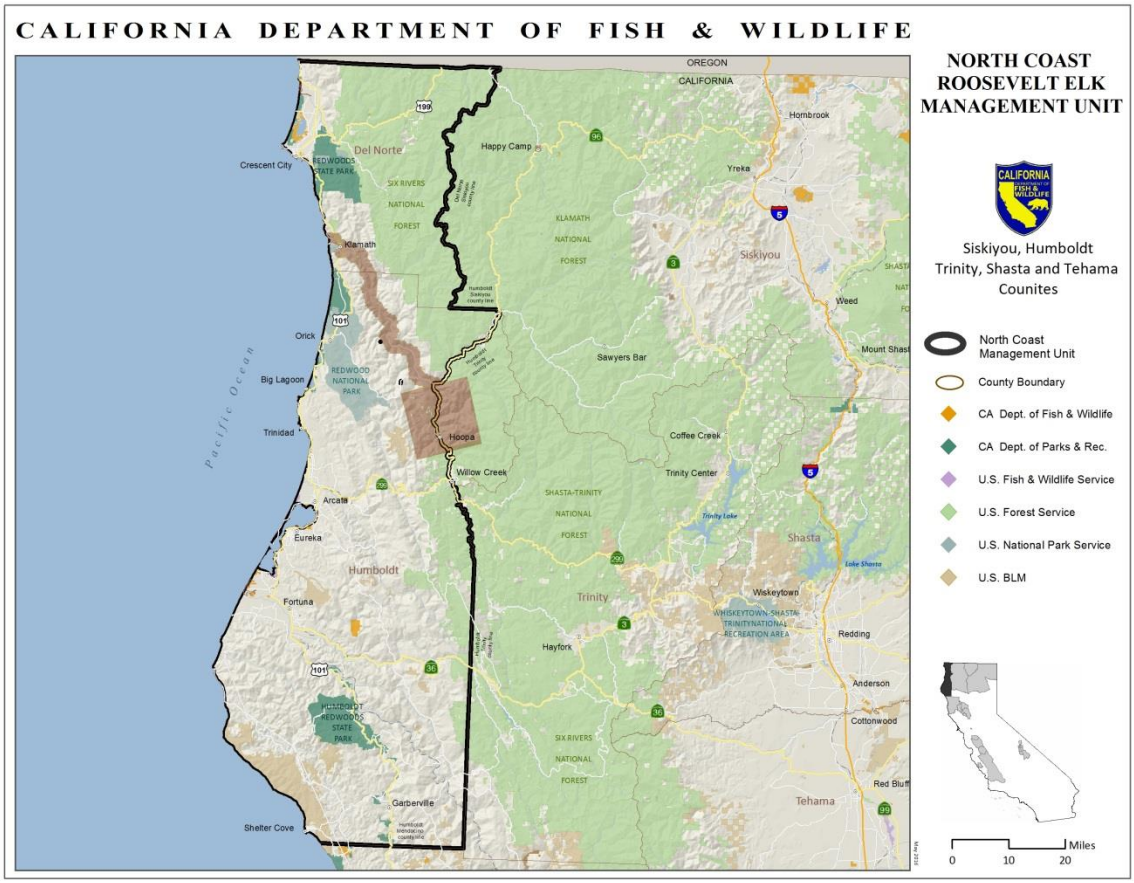
LITERATURE CITED

British Columbia Ministry of Agriculture, Food and Fisheries. 2001. Elk exclosure using woven wire fencing. Factsheet 307.252-1. 9pp.

British Columbia Ministry of Agriculture, Food and Fisheries. 2001. Elk exclosure using electric fencing. Factsheet 307.252-2. 8pp.

Appendix E: Herd Management Plans for High Priority Areas (Elk Management Units).

North Coast Roosevelt Elk Management Unit



North Coast
Roosevelt Elk Management Unit

Description

The North Coast Roosevelt Elk Management Unit (Unit) encompasses Humboldt and Del Norte counties, except for a portion of Humboldt County east of Highway 96 which occurs within the Marble Mountains Elk Management Unit. The Unit is within the North Coast and Klamath province as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015), and is associated with the Northern California Coast, Northern California Coast Ranges, and Klamath Mountains ecoregions. Approximately 60% of the Unit is privately owned, with most public land administered by the United States Department of Agriculture Forest Service (USFS; Six Rivers National Forest), United States Department of Interior Bureau of Land Management (BLM; Lacks Creek and King Range), and Redwood National and State Parks (RNSP).

Elevation ranges from sea level to over 6,000 feet. Areas of suitable elk habitat occur throughout the Unit, including conifer and mixed conifer-hardwood forests, oak woodlands, montane and bottomland grasslands, and wetlands. Private land inhabited by elk includes timberlands, ranches, dairies, farms, and rural residential areas. Habitat quality, quantity, and the arrangement of vegetation types influence the presence and abundance of elk locally. The coastal climate is temperate. Summer daytime temperatures can exceed 90°F at inland locations and winter temperatures below freezing occur. Annual precipitation ranges from 45 to 80 inches.

Non-consumptive use and enjoyment of elk within the Unit exceeds consumptive use and includes viewing, photography, shed hunting, and nature study. Collecting shed antlers is prohibited within RNSP. Opportunities are limited on public land, but elk viewing is available on RNSP and California Department of Fish and Wildlife (Department) holdings (North Coast Wildlife Area Complex). Elk seldom occur on lands managed by the USFS and BLM.

Although 80 % of the public land within the Unit is open to elk hunting (hunting is prohibited in federal and state parks), relatively few elk occur on public land open to hunting. Opportunities to hunt elk on some private lands are available to the public through fee-based access during the general hunt season, on lands enrolled in the Private Lands Management Program (PLM), or through the Shared Habitat Alliance for Recreational Enhancement (SHARE) program.

Elk Distribution and Abundance

Harper et al. (1967) described the historical distribution of Roosevelt elk in California. Roosevelt elk were found throughout the Unit prior to the arrival of non-indigenous humans, but were decimated by the early 1900s and restricted to a small portion of coastal Humboldt and Del Norte counties (Barnes 1925*a*, 1925*b*). Harper et al. (1967) speculated that Humboldt and Del Norte counties supported 1,000-2,000 elk that were in no danger of extinction. Elk have increased in number and distribution since 1967 and now occur throughout the northwestern portion of the Unit on public, private, and tribal lands, with patchy distribution extending into central Humboldt County. The Unit contains a significant amount of suitable habitat unoccupied by elk. Conflicts will likely increase as elk populations expand on private lands within the Unit.

The Department has completed at least two capture and translocation projects within the Unit. From 1947-1965, 51 elk were translocated to Bear Basin in Del Norte County from what is now RNSP. From 1982-1984, 24 elk were translocated to BLM's King Range National Conservation Area in southern Humboldt County, from RNSP. In addition, the Department has translocated more than 250 Roosevelt elk from Oregon locations (e.g., Jewell Wildlife Area, Dean Creek Wildlife Area) to Siskiyou and Trinity counties since the late 1980s, some of which have subsequently dispersed into the Unit.

The Department did not conduct systematic elk surveys in this Unit prior to 2016, although portions were surveyed periodically, primarily on land administered by RNSP. Galea and Golightly (1987) monitored elk on private timberland near Big Lagoon in Humboldt County (adjacent to RNSP). Weckerly (1996) monitored elk on private timberland in Del Norte County, and on private timberland and public land near the northern boundary of RNSP in Humboldt County. McCoy (1986) monitored movements and habitat use of elk reintroduced to the King Range in southern Humboldt County. Department personnel conducted limited ground surveys (2012 and 2013) and fixed-wing flights in 2015. Beginning in 2016, Department personnel implemented systematic ground counts in portions of Del Norte and Humboldt counties, including areas with ongoing private property conflicts. Humboldt State University (HSU) is implementing a pilot fecal DNA analysis, road surveys, and GPS radio telemetry project to assist with population monitoring through a Department grant.

RNSP has been documenting relative abundance of elk within park boundaries since 1996. They identified seven groups that exist within the boundaries of the park. With few exceptions, they have surveyed each on an annual basis. In 2014, they surveyed all but one group, and the total count of elk within the park was 408 individuals (Redwood National and State Parks 2015). RNSP has been using adult cow counts (includes cow, calf, and spike groups) as an indicator of persistence. The total number of cows in all groups within the park has increased from 153 in 1997 to 352 in 2014. These counts did not include Gold Bluffs Beach (Crescent Beach Education Center - CBEC) group counts (Redwood National and State Parks 2015).

Julian et al. (2013) noted that group sizes in the park declined from 1997 to 2010, however the authors only examined five of the seven groups in this paper, (Bald Hills and CBEC groups were excluded). Notably, the Bald Hills group has shown a fivefold increase from 1997 to 2014, and the CBEC has limited survey data due to staffing constraints (Redwood National and State Parks 2015). Department surveys in 2016 and 2017 (road counts and opportunistic observations of groups of elk with GPS collars) documented 990 elk in 22 distinct groups in a portion of Del Norte and Northern Humboldt counties.

It is difficult to reliably estimate elk population numbers or monitor trends in the densely forested north coast because of limited observability. Because of this, and based on available information from Department surveys, private landowners, harvest data, and data from RNSP, the Department currently estimates a population of 1,600 elk in the Unit. This estimate is a general approximation subject to change based on new or additional survey information.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental changeIncrease elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 4) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1.Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental changeIncrease elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is increasing and has not reached the upper population identified in Objective 1.7. In 2015, the Department hired dedicated staff to implement an elk monitoring and research program for this Unit to examine distribution and abundance of elk groups and guide population and habitat management activities. In addition, in 2016 the Department awarded a multi-year grant to HSU to expand on the Department's efforts in assessing elk populations and habitats. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk populations and habitat.

Population management for this Unit includes efforts to increase elk numbers where suitable on public lands, while working to stabilize elk numbers in conflict areas. This will involve a conservative level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict, and targeted elk hunting and depredation relief in areas where reoccurring conflict with agriculture and humans exists.

Currently, elk appear to utilize private lands disproportionate to their availability that, in some areas, causes conflict with landowners. Expanding of elk on private lands where they are tolerated is one method to successfully increase the populations. Such private lands include timberlands, ownerships enrolled in the PLM or SHARE programs, and other properties where landowners desire elk. Where suitable unoccupied elk habitat exists, management actions should facilitate natural dispersal or through translocations to reestablish elk where conflicts will be minimal.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. Enhancing elk habitat within the North Coast Unit is especially critical where conversion of native prairies has transformed over 90% of open prairie to brush and/or conifer forest in just the last 70 years. These transformed habitats no longer have the same habitat benefits for elk. To achieve these objectives, the Department will collaborate with state and federal agencies, Tribes, and private landowners.

Objective 1.1. Continue and complete projects to estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue to affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to determine seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2021.

Action 1.1.2
Continue to collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10%, by 2028, in areas where human-elk conflicts are expected to be minimal.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Action 1.2.3
Coordinate with public land agencies, Tribes, and NGOs and establish a timeline to evaluate the potential for elk translocations. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, RNSP, California Department of Forestry and Fire Protection, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance oak woodlands, montane prairies, and other elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Collaborate with HSU to collect habitat use data to identify areas utilized by elk and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.5
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.6
Annually provide technical support and advice to RNSP on oak woodland and prairie enhancement projects to identify specific management actions and habitat projects to benefit elk. Ongoing.

Action 1.3.7
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2023.

Action 1.4.1
Collaborate with HSU on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2021.

Objective 1.5. Collaborate with California Department of Transportation (CalTrans) to provide information and recommendations to reduce vehicle collisions along the Highway 101 corridor by 2023.

Action 1.5.1
Examine existing GPS collar and elk survey data to assist in determining elk use along the Highway 101. Expected completion: 2021.

Action 1.5.2
Utilize collar and survey data from newly implemented projects to obtain additional data on elk presence and mortality along Highway 101 Corridor. Expected completion: 2023.

Action 1.5.3
Provide recommendation to CalTrans for management actions to reduce vehicle collisions along Highway 101. Expected completion: 2023.

Objective 1.6. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.6.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.6.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.6.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.7. Maintain a population of 1,300-4,000 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.7.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.7.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes.

Tribes have identified various issues for this Unit, including the lack of habitat enhancement of Tribal lands by non-tribal entities that has resulted in overgrown shrub layers, dense first and second growth forest, and encroachment of woody vegetation and scrub onto native prairies. These habitat changes all result in reduced elk habitat values. Due to concerns about the role of fire suppression in limiting potential elk habitat, returning fire to the landscape is a prominent goal of Tribes. Tribes actively plan elk habitat enhancements and carry out restoration projects.

Other identified issues include the need to assess the number and composition of elk populations utilizing tribal lands, the need for habitat restoration, the presence of feral cattle which compete for available suitable habitat, the significance of potential limiting factors affecting elk management, the potential for translocation of elk onto tribal land, and regulation of hunting, among others. One Tribe is currently developing a

comprehensive hunting ordinance that will give elk the opportunity to become reestablished once suitable habitat exists. The Department is committed to working with Tribes on enhancing elk habitat.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes to develop co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Objective 2.2. Work with Tribes to complete at least two monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat by 2023.

Action 2.2.1
Collaborate with interested Tribes to identify monitoring and habitat projects and establish a timeline for implementation. Expected completion: 2019.

Action 2.2.2
Coordinate with interested Tribes to identify Department approved research projects utilizing GPS collars to assess use of Tribal and adjoining lands as part of ongoing studies. Expected completion: 2023.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography, and nature study. Coordination with RNSP and HSU is a vital component to informing the public about elk, and to developing additional wildlife interpretive signs and viewing areas.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the

Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. This Unit is large and contains numerous elk groups for which the Department may consider different management options. This may include dividing the hunt zone into smaller units and setting tag quotas for the smaller areas/subherds. Another option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts and reduce hunting pressure on elk inhabiting public lands.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits. Other projects to improve public hunting access on private land have yet to be implemented within the Unit, but as additional landowners learn about the SHARE program, public access opportunities for elk hunting may increase. Tribes have expressed interest in the SHARE program and in increased coordination with the Department in elk management efforts.

Objective 3.1. Increase elk hunting opportunities by 10% by 2023, where feasible and compatible with population objectives.

Action 3.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities and the potential to divide the Unit into smaller hunt zones. Expected completion: 2020.

Action 3.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Action 3.1.3
Increase elk hunting opportunities on USFS and BLM holdings when appropriate. Elk hunting opportunities should occur at a level that does not inhibit maintenance and expansion of the elk population on public land. Ongoing.

Objective 3.2. Work with other agencies and NGOs to install two additional elk interpretive signs by 2023.

Action 3.2.1
Meet with land agencies to evaluate the possibility of adding and/or updating elk interpretive signs. Expected completion: 2020.

Action 3.2.2
Evaluate the feasibility of adding an elk interpretive sign to the North Coast Wildlife Area Complex. Expected completion: 2020.

Objective 3.3. Conduct an elk workshop to inform the public about elk and elk viewing opportunities by 2023.

Action 3.3.1
Work with agencies, academia, and NGOs to provide information on elk and elk viewing at the workshop. Expected completion: 2022.

Objective 3.4. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population approaches the maximum objective for the Unit, additional actions to control their numbers may be necessary. Management actions are currently needed in some areas of the Unit where private property conflicts occur and elk populations are increasing.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. The Department can adjust annual harvests to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve tolerance of elk on their properties. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting and co-management with Tribes to address chronic or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when identifiable animals cause property damage.

Objective 4.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 4.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 4.1.4
Develop specific elk hunting boundaries (sub-divide Unit into multiple elk zones) to better distribute harvest to assist in alleviating private property conflicts and localized increases in elk populations. Expected completion: 2020.

Action 4.1.5
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.6
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Since the early 1900s, both the elk population and their range within the Unit has been growing. This growth has occurred despite increasing human population density and development activities. Much of the Unit contains suitable elk habitat, so the potential for continued increase over the next 10 years is high. A substantial portion of suitable habitat occurs within ownerships where human-elk conflicts are minimal. For those areas where human-elk conflicts occur or may develop, landowners may tolerate elk if the population is maintained at a level that does not unduly inhibit agricultural activities and, if opportunities are provided for landowners to benefit economically through regulated hunting.

There is potential for movement and interchange of elk within the Unit into adjacent units, and as far north as Oregon. Emigration of elk into the Unit from adjacent units (e.g., Marble Mountains unit and Oregon) occurs occasionally. However, most increases in the population and distribution of elk on the North Coast likely occurs through reproduction and dispersal of elk within the Unit. Elk density appears stable in the coastal redwood belt, whereas numbers may be slowly increasing further inland.

Summary of Annual Harvests

- Historical tag quotas and harvests in Humboldt County from 1963 to 1984 are listed in Table 1 (Dasmann 1975). During this period, public elk hunting occurred periodically at specific locations in the Unit, generally on private land at the invitation of industrial timber companies. These hunts were very popular (almost 13,000 applications were received for 100 tags issued in 1984), but did not occur annually until 1993.

- The Fish and Game Commission (FGC) authorized the Del Norte Roosevelt Elk Hunt in the Smith River area of Del Norte County in 1993, and it occurred annually through 2013 on private land owned and managed by Green Diamond Resource Company. Table 2 lists tag quotas and harvests for the Del Norte hunt; hunter success was very high.

- The FGC authorized the Klamath Roosevelt Elk Hunt in southern Del Norte and northern Humboldt counties in 1988 and 1989, which occurred annually from 1998 to 2014 (Table 3). Annual hunter success varied from 14-70%. The Klamath hunt occurred on land owned or leased by Green Diamond Resource Company.

- The Big Lagoon Roosevelt Elk Hunt in Humboldt County was authorized by the FGC in 1988 and 1989 and occurred annually from 2000 to 2014 (Table 4). Annual hunter success varied from less than 10% to over 90%. The Big Lagoon hunt occurred on land owned or leased by California Redwood Company and Green Diamond Resource Company.

- The Northwestern California Roosevelt Elk Hunt was first authorized by the FGC in 2007 and has occurred annually. Annual hunter success has been generally high for this hunt (Table 5). The Northwestern zone includes public and private property, but most of the elk accessible to hunters are on private land. Some landowners provide fee access to public tag holders; others who receive a Cooperative Elk Hunting Tag offer it for sale. Public lands open to hunting within the zone include the Six Rivers National Forest and the BLM's King Range National Conservation Area.

- Cooperative Elk Hunting tags became available in 2000 and have been issued for each hunt in the Unit (Tables 2-5). The FGC authorized annual elk hunting under the PLM program within the Unit in 2007, when the 7,000-acre Stover Ranch became a licensed participant. Since 2010, nine additional PLMs were authorized by the FGC (Table 6).

Prior to the arrival of non-indigenous human settlers to the region in the mid-1800s, harvest of elk by Tribes was regulated by tribal tradition and need. Adherence to traditional practices prevented over-harvest, promoted maintenance of elk habitat, minimized waste of elk materials, and exhibited intense respect for the resource. Current tribal regulation of elk harvest on reservations varies. Although population levels in many tribal areas are low due to poor habitat condition, these same conditions make harvest extremely difficult.

Tooth samples are collected from hunter-killed elk within the Unit, for age determination based on analysis of cementum annuli. Figure 1 depicts average (mean) age of antlered and antlerless elk for the Del Norte, Klamath, Big Lagoon and Northwestern hunts.

Tooth age data (Figure 1) does not suggest declining age trends in either antlered or antlerless elk. Due to small sample sizes, it is difficult to establish statistically valid trends through time, but the information provides additional data to help the Department evaluate potential impacts from hunting. From 2007 to 2016, the annual harvest represents approximately 3 % of the estimated minimum elk population.

Unit Highlights

The Department has monitored elk within the Unit and collaborated with land management agencies and NGOs to implement research and management activities. Below is a partial listing of these activities:

- RNSP, USFS, BLM, and the Department have completed elk habitat maintenance and enhancement projects on lands they manage. Some of these projects were completed with the assistance of Rocky Mountain Elk Foundation, Mule Deer Foundation, and California Deer Association. Projects improving habitat for elk have also been completed through PLM and grants awarded by the United States Fish and Wildlife Service and the Natural Resource Conservation Service.

- In the early 2000’s, the Department collected GPS collar data from five elk captured in Bald Hills, Crannell, and Rowdy Creek vicinities.

- In 2017, Department personnel outfitted 17 adult cow elk with GPS collars, and 20 calves were with VHF ear tag transmitters.

- Non-consumptive public use has increased with the expansion of the elk population.

A number of elk-related studies conducted within the Unit, primarily by universities, are published. Most of these focused on the remnant elk population that occurred in what is now RNSP. A partial list of these and other studies submitted to the Department includes the following:

Unit Specific Research

Bentley, W. W. 1959. The range relationships of Roosevelt elk *Cervus canadensis roosevelti*, (Merriam), at Prairie Creek Redwoods State Park, Humboldt County, California, in 1958. Thesis, Humboldt State University, Arcata, California, USA.

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Table 1. Roosevelt Elk Tag Quotas and Harvests in Humboldt County, 1963-1984.

Year	General Either-Sex			Bull		Antlerless	
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1963				25	24	50	44
1964				35	29	65	58
1967				8	5	17	13
1974				12	11	38	15
1976	50	17	8				
1984	100	34	15				
Totals	**150**	**51**	**23**	**80**	**69**	**170**	**130**
Success Rate	**49%**			**86%**		**76%**	

Sources: CDFW Files, Dasmann 1975

Table 2. Del Norte Elk Hunt, Tag Quotas and Harvests, 1993-2013.

Year	General Either-Sex			Bull		Antlerless		Cooperative Elk Hunting		
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest
1993	15	10	3							
1994				5	5	10	6			
1995				5	3	10	9			
1996				5	5	10	9			
1997				5	5	10	9			
1998				5	5	10	9			
1999				5	5	10	8			
2000				10	8	5	4	1	1	
2001				10	7	5	1	2	2	
2002				10	9	5	3	1	1	
2003				10	9	5	5	1	1	
2004				10	9	5	5	1	0	
2005				10	10	5	4	1	1	
2006				10	6	5	3	1	1	
2007				5	4	15	14	1	1	
2008				5	5	10	10	1	0	
2009				5	5	10	4	1	1	
2010				5	3	10	4	1	0	
2011				5	4	10	8	1	1	
2012				5	4	10	7	1	1	
2013				5	5	10	8	1	0	
Totals	**15**	**10**	**3**	**135**	**116**	**170**	**130**	**15**	**11**	**0**
Success Rate	**87%**			**86%**		**76%**		**73%**		

Table 3. Klamath Elk Hunt, Tag Quotas and Harvests, 1988-2014.

Year	Either-Sex			Bull		Antlerless		Cooperative Elk Hunting		
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest
1988	50	5	5							
1989	50	5	2							
1998	50	7	1							
1999	50	7	1							
2000	30	3	1							
2001	30	15	1							
2002				15	5	15	8	1		
2003				15	6	15	2	1	0	
2004				10	5	10	4	1	1	
2005				10	8	10	6	1	0	
2006				10	7	10	5	1	0	
2007				10	6	10	8	1	1	
2008				10	6	10	1	1	0	
2009				10	6	10	4	1	1	
2010				10	4	10	8	1	1	
2011				10	3	10	2	1	0	
2012				5	4	5	2	1	1	
2013				5	3	5	0	1	0	
2014				5	1	0	0	1	0	
Totals	**260**	**42**	**11**	**125**	**64**	**120**	**50**	**13**	**5**	**0**
Success Rate	**20%**			**51%**		**42%**		**38%**		

Table 4. Big Lagoon Elk Hunt, Tag Quotas and Harvests, 1988-2014.

Year	General Either-Sex			Bull		Antlerless		Cooperative Elk Hunting		
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest
1988	50	14	15							
1989	50	11	8							
2000	25	18	2					1	1	
2001	25	9	1					1		
2002				12	3	13	2	1	1	
2003				12	2	13	1	1	1	
2004				12	4	13	3	1	1	
2005				12	3	13	6	1		
2006				6	1	6	0	1		
2007	5	2	1					1	1	
2008	10	9						1		1
2009	10	7						1		
2010				5	1	5	0	1	1	
2011				5	3	5	2	1	1	
2012				5	4	5	2	1	1	
2013				5	3	5	1	1	1	
2014				5	5	0	0	1	0	
Totals	**175**	**70**	**27**	**79**	**29**	**78**	**17**	**15**	**9**	**1**
Success Rate	**55%**			**37%**		**22%**		**67%**		

* Total Harvest for 1984 was 49 elk, with 20 "trophy" bulls taken (Galea 1987).
Previous progress reports by Galea reported 29 "'trophy" bulls--- however 20 is in the final report. Galea also reported that 5 bulls and 25 cows were taken from LP land in 1964.

Table 5. Northwestern California Roosevelt Elk Zone, Tag Quotas and Harvests, 2007-2016. Table does not include quotas and harvest for Big Lagoon, Del Norte, and Klamath hunts, which are reported separately.

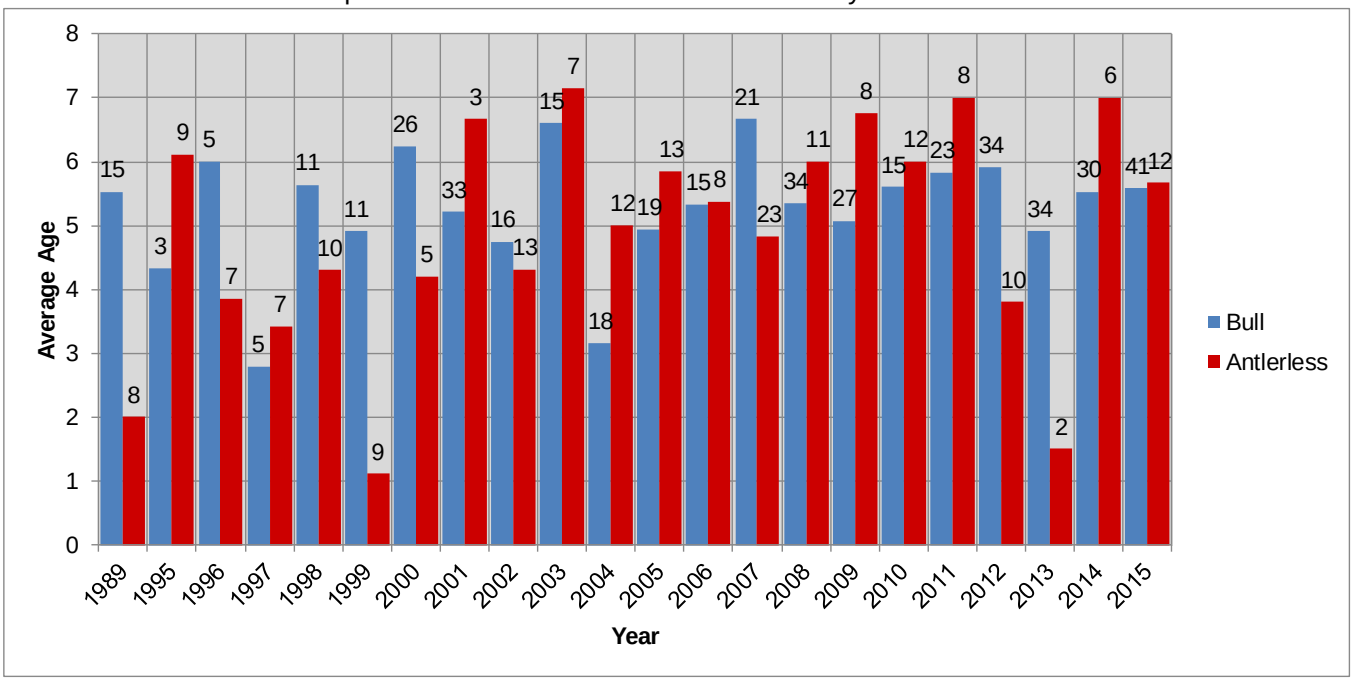
Year	General Either-Sex			Bull		Cooperative Elk Hunting		
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest
2007	10	9	0			2	0	0
2008	20	17	0			4	3	0
2009	20	13	1			4	3	0
2010	20	12	3			4	4	0
2011	20	16	0			4	2	0
2012	20	15	0			4	4	0
2013	20	19	0			4	2	1
2014	30	22	3			6	2	0
2015	45	33	2			6	4	0
2016				15	12	3	3	0
Totals	**205**	**156**	**9**	**15**	**12**	**41**	**27**	**1**
Success Rate	**80%**			**80%**		**68%**		

Table 6. North Coast, Reported Private Lands Management Area Harvests, 2008-2016.

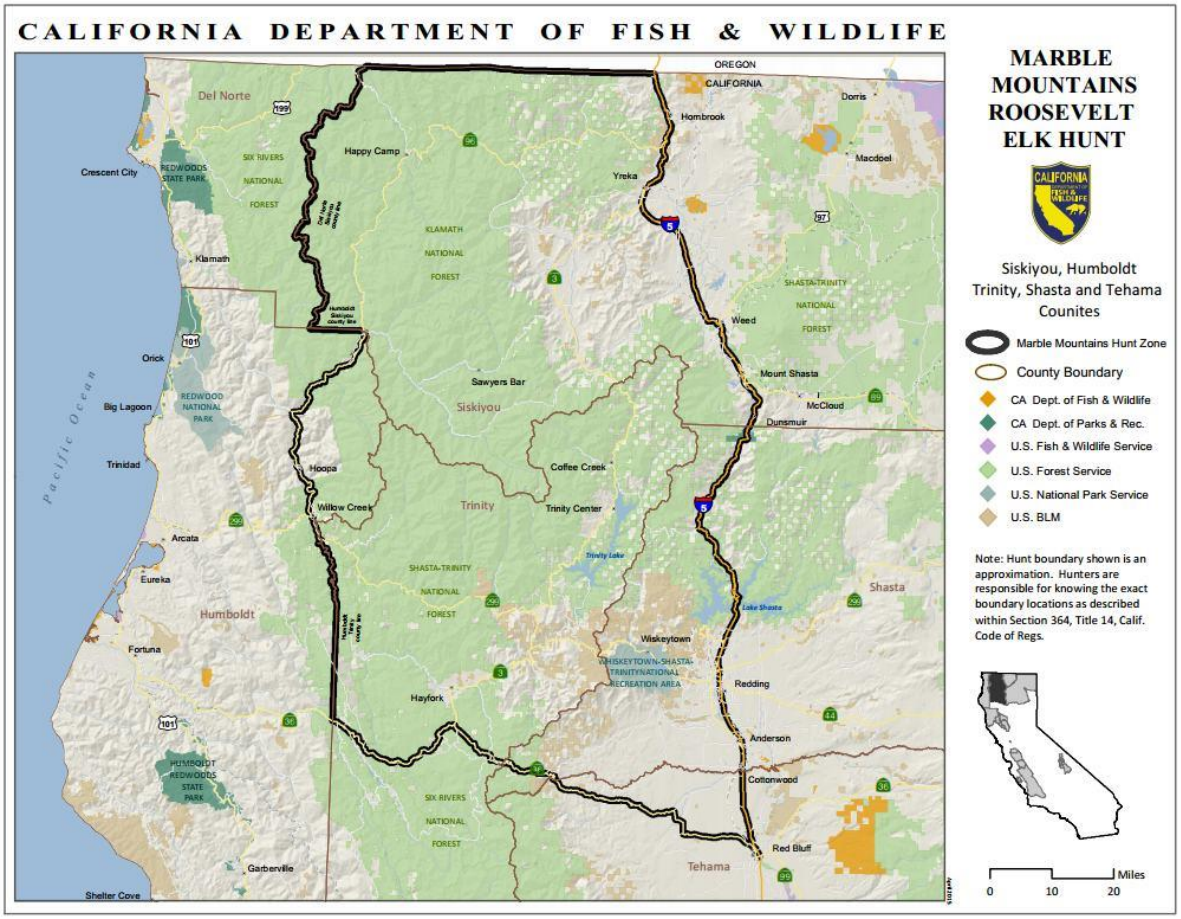
Year	Authorized Bull Tags	Authorized Antlerless Tags	Bull Harvest	Antlerless Harvest	# of PLMs
2008	2	1	0	1	1
2009	2	1	2	1	1
2010	3	1	2	1	2
2011	3	1	3	1	2
2012	6	2	6	2	3
2013	9	4	8	1	5
2014	13	5	10	4	7
2015	20	15	19	14	10
2016	21	19	19	17	10
Total	**79**	**49**	**69**	**42**	

No PLM tags were issued until 2008.

Figure 1 – Average age of harvested elk for all zones in North Coast Unit Combined. Sample sizes are denoted above bars for each year.



Marble Mountains Roosevelt Elk Management Unit



Marble Mountains
Roosevelt Elk Management Unit

Description

The Marble Mountains Elk Management Unit (Unit) includes parts of Humboldt, Siskiyou, Trinity, Shasta and Tehama counties and spans approximately 4.5 million acres. Boundaries are as follows: beginning at the intersection of Interstate Highway 5 and the California-Oregon state line; west along the state line to the Del Norte County line; south along the Del Norte County line to the Siskiyou-Humboldt County line; east along the Siskiyou-Humboldt County line to Highway 96; south along Highway 96 to Highway 299; south along Highway 299 to the Humboldt-Trinity County line; south along the Humboldt-Trinity County Line to the intersection of Highway 36; east along Highway 36 to Interstate Highway 5; north along Interstate Highway 5 to the point of beginning.

The Unit is within the North Coast and Klamath, Cascades, and Modoc Plateau Provinces as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). Topography is characterized by steep and diverse terrain. Coastal watersheds are separated by high elevation ranges that exceed 8,500 feet in some wilderness areas; the watersheds extend to the Pacific Ocean as narrow river valleys. The majority of this region is densely forested with a variety of trees including hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), Douglas fir (*Pseudotsuga menziesi*i), chinquapin (*Chrysolepis chrysophylla*), noble fir (*A. procera*), white fir (*A. concolor*) and red fir (*A. magnifica*). Common shrubs include wedgeleaf ceanothus (*Ceanothus cuneatus*) and mahogany (*Cercocarpus sp*.).

Quality habitat on Roosevelt elk (*Cervus canadensis roosevelti)* summer range is characterized by lush, high mountain meadows where grasses and forbs provide highly nutritious forage. Transition range occurs at a broad elevation band between summer and winter range, where Douglas fir types at lower elevations grade into white fir types at the upper elevations. Winter range is typically below 2,500 feet within the Douglas fir – tanoak zone. Steep, rocky slopes of southerly aspects commonly have canyon live oak (*Quercus chrysolepis)* as the major hardwood. Conifer plantations of varying ages are dispersed throughout this transitional range. Remnant deciduous oak woodlands provide valuable grasses and forbs. Greatest forage utilization during winter occurs along river bars and first terraces of the Klamath River where stands of conifers and oaks are dominant. Small meadows and openings within these areas and along highway right-of-ways provide high quality early seral forage and can be heavily utilized by elk in winter.

Approximately 66% of the Unit is public land, administered by the United States Department of Agriculture Forest Service (USFS) and the United States Department of Interior Bureau of Land Management (BLM). Access to higher elevations (summer range) and transition zones is good, but steep and difficult terrain makes access to

some areas challenging. Pack stock are a common mode of travel in the Marble Mountains Wilderness Area and some tagholders for this hunt employ guides/packers. Access to private land is generally restricted. Portions of the Unit are owned by large private timber companies that allow public access; however, vehicle access may be seasonally restricted. Winter range at lower elevations and along river valleys can be privately owned with restricted access.

Non-consumptive use of elk within the Unit exceeds consumptive use. Recreational activities involving elk include hunting, photography, viewing, nature study, and shed collecting.

Elk Distribution and Abundance

The Unit is within historical Roosevelt elk range as depicted by Harper et al. (1967). Elk were extirpated from the Unit by the late 1800s, but (Harn 1958) noted anecdotal reports of individuals and small groups of elk in Trinity and Siskiyou counties in the mid-1900s. The California Department of Fish and Wildlife (Department) began reintroductions in 1985 (Galea 1987), and has since released over 250 Roosevelt elk at multiple sites within the Unit. These reintroductions were focused within the Klamath National Forest (KNF) and the Marble Mountain Wilderness in cooperation with the USFS and consultation with the Karuk Tribe (Klamath National Forest 2007). Elk now reoccupy portions of the Unit and the population is estimated at approximately 3,000 animals. Non-hunting mortality factors have not been investigated but likely include predation, disease, and vehicle collisions. Poaching has been documented within the Unit and may be a significant mortality factor.

The Department has limited information regarding population parameters for the Unit. Kitchen and Woodard (1996) monitored elk within the Elk Creek drainage seasonally from July-December 1993 and June-October 1994, and estimated population numbers at 332 $\pm$ 250 elk based on mark-recapture (re-sight) methods. In the early 1990's and 2000's the Department used fixed-wing aircraft and helicopters to survey and monitor elk reintroduced from Oregon that were equipped with VHF radio transmitters. Elk were extremely difficult to locate from the air (even those equipped with VHF transmitters) because of the dense canopy of mixed conifers and shrubs. The Department is currently developing techniques to assist in monitoring demographic trends through time.

In 2015, the Department issued a grant to the non-governmental organization (NGO) Rocky Mountain Elk Foundation (RMEF) to conduct ground counts in portions of the Marble Mountain Wilderness. Collaboration has continued with RMEF and Sierra Pacific Industries in 2016 to estimate cow:calf ratios using infrared video cameras in Trinity County. This work is being conducted in the Douglas City and Trinity Center areas, in the southern portion of the Unit. Suitable unoccupied habitat exists within the Unit (based on historical distribution) and there is potential for continued expansion of elk range.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental changeIncrease elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 4) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental changeIncrease elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The Department considers the elk population to be increasing and has not reached the upper population identified in Objective 1.6. In 2015, the Department hired dedicated staff to implement an elk monitoring and research program for this Unit to estimate the parameters needed to guide population and habitat management activities. The parameters include abundance, distribution, demography, habitat use, and overall health. Elk management for this Unit involves efforts to increase elk numbers, where suitable on public lands, while working to stabilize elk numbers in areas where conflicts may occur. It will involve a conservative level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict, and targeted elk hunting and depredation relief in areas where reoccurring conflict with agriculture and humans exists.

It is important to investigate the details of elk ecological requirements. While forage and cover requirements of Roosevelt elk are generally well known, these features are largely undescribed for the Unit and limited satellite telemetry studies have been conducted at specific locations. The retention of appropriate quantity and distribution of these habitat components will support the existing elk population and allow dispersal and expansion, especially onto public lands. The KNF (2007) modeled the restoration potential of elk habitats using the Arc Habitat Suitability Index developed by the USFS Rocky Mountain Research Station. This model uses “best guess” determinations for the juxtaposition of elk habitat components (i.e., forage and cover) in relationship to each other and road density/use to describe the potential quality of elk habitats.

Private lands where the presence of elk may be tolerated or encouraged including timberlands, ownerships enrolled in the Private Lands Management (PLM) program, and other properties where elk are desired by the landowner, are also important components of the Department's goal to increase elk populations. Where suitable unoccupied elk habitat exists, management actions should facilitate natural dispersal or through translocations to reestablish elk where conflicts will be minimal.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects within forested communities promotes a mix of habitat types and successional stages, including forest openings and meadows that benefit elk. To achieve these objectives, the Department will collaborate with state and federal agencies, Tribes, and private landowners.

Objective 1.1. Continue and complete projects to estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue to affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2021.

Action 1.1.2
Collaborate with academia, NGOs, and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicles surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Action 1.2.3
Coordinate with public land agencies, Tribes, and NGOs and establish a timeline to evaluate the potential for elk translocations. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, California Department of Forestry and Fire Protection, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2023.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2023.

Objective 1.5. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 3,000-6,000 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes.

Identified issues include; the need to assess the number and composition of elk populations; the need for habitat restoration; the significance of potential limiting factors affecting elk management; and regulation of hunting, among others. The Department is committed to working with Tribes on enhancing elk habitat.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes to develop co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Objective 2.2. Work with Tribes to complete at least one monitoring and/or habitat project that will assist in guiding management decisions or enhancing elk habitat by 2023.

Action 2.2.1
Collaborate with interested Tribes to identify monitoring and habitat projects and establish a timeline for implementation. Expected completion: 2019.

Action 2.2.2
Coordinate with interested Tribes to identify Department approved research projects utilizing GPS collars to assess use of Tribal and adjoining lands as part of ongoing studies. Expected completion: 2023.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. This Unit is large and contains numerous elk groups for which the Department may consider different management options. This may include dividing the hunt zone into smaller units and setting tag quotas for the smaller areas.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 3.1. Increase elk hunting opportunities by 10% by 2023, where feasible and compatible with population objectives.

Action 3.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities and the potential to divide the Unit into smaller hunt zones. Expected completion: 2020.

Action 3.1.2
Utilize the Shared Habitat Alliance for Recreational Enhancement (SHARE) program to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Objective 3.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.2.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population approaches the upper population objective for the Unit, actions to control population numbers may become necessary. Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program currently is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. The Department can adjust annual harvests to address human-elk conflicts. Where substantial human-elk conflicts occur, the Department may implement elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve their tolerance of elk. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting and co-management with Tribes to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

Objective 4.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 4.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 4.1.4
Develop specific elk hunting boundaries (and/or sub-divide Unit into multiple elk zones) to distribute harvest and assist in alleviating private property conflicts and localized increases in elk populations. Expected completion: 2020.

Action 4.1.5
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.6
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Through successful re-introductions and natural dispersal over the last 30 years, elk occupy many portions of the Unit. Elk numbers appear to be increasing, but local fluctuations occur which may be linked to recent large-scale fires.

There is potential for the natural interchange of individual elk between adjacent management units in California (as well as Oregon). Long-term monitoring of elk distribution and movements would help the Department to understand the rate of

exchange between these units. The Unit is large and contains a significant amount of suitable unoccupied habitat that could contribute to the long-term viability of elk barring cataclysmic events, declines in genetic health, or adverse human interference. In the future, it is possible that human tolerance for elk on private property will be important in determining an upper population limit for some portions of the Unit.

Summary of Annual Harvests

The Fish and Game Commission first authorized annual public elk hunting within the Unit in 1996. In total, 855 public elk tags were issued from 1996-2016, with a cumulative hunter success of 57% (Table 1). Cooperative Elk Hunting tags became available in 2000. The Department has expanded hunt boundaries on at least three occasions since 1996; the current hunt zone is four to five times larger than the initial hunt zone. Elk hunting has not occurred under the PLM program in this Unit.

Initially, the Department issued either-sex tags for the Unit to optimize hunter opportunity. However, the cumulative harvest disproportionately favored bulls, so in 2010, specified numbers of antlerless and bull tags were issued to encourage take of females and reduce hunting pressure on bulls. In 2006, Apprentice (Junior) Hunter either-sex tags were established for the Unit and in 2010, Muzzleloader/Archery either-sex tags were established; these designations provide additional hunting opportunities for specific user groups.

Mean age of elk within the Unit, based on analysis of cementum annuli of tooth samples from hunter-killed elk from 1997-2015, is depicted in Figure 1. Annual mean age for bulls ranged from 4.2-7.1 years, whereas mean age for antlerless elk ranged from <1.0-11.5 years.

Total sample size for antlerless elk is relatively small and not collected every year. Despite these limitations, age information suggests that the majority of male and female elk taken by hunters within the Unit experienced reproductive opportunities for multiple years. The age data does not indicate that conservative harvest levels have adversely affected the elk population (Figure 1).

Unit Highlights

Elk have become reestablished within the Unit and continue to expand. The Department has collaborated with land management agencies and non-governmental organizations to implement research and management activities. Below is a partial listing of these activities:

- Monitoring elk distribution and behavior based on satellite (GPS) and VHF radio-telemetry has provided information limited to specific locations of the South Fork Salmon and Klamath River areas.

- Department personnel developed a technique to capture elk in this remote, closed-canopy region using potable panel traps and a non-narcotic alternative to immobilization.

- Thematic modeling of elk habitats during the 1990s provided a coarse understanding of the quality of elk habitats in northern California.

- In 2015, the Department hired dedicated staff to implement elk monitoring and research within this Unit.

The Department also has collaborated with universities, NGOs, and the USFS to develop other monitoring and management activities within the Unit. A partial listing of these and other studies submitted to the Department includes the following:

Unit Specific Research

Meredith, E.P., J.A. Rodzen, J.D. Banks, R. Schaefer, H.B. Ernest, R.R. Famula and B.P. May. 2007. Microsatellite analysis of three subspecies of elk (*Cervus elaphus*) in California. Journal of Mammalogy 88(3):801-808.

Schaefer, R.J., B.J. Gonzales, and F. Schmalenberger. 2009. Panel trapping and reversible immobilization of wild Roosevelt elk with telazol and medetomidine. California Fish and Game 95(2): 65-76.

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California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

Galea, F.L. 1987. Status Report: Marble Mountains Roosevelt elk reintroduction project. Unpublished report submitted to California Department of Fish and Game and the Rocky Mountain Elk Foundation. December 31, 1987.

Harn, J.H. 1958. The Roosevelt Elk, *Cervus canadensis roosevelti* (Merriam), at Prairie Creek Redwoods State Park, Humboldt County, California. Thesis, Humboldt State University, Arcata, California, USA.

Harper, J.A., J.H. Harn, W.W. Bentley, and C.F. Yocum. 1967. The status and ecology of the Roosevelt elk in California. Wildlife Monographs 16:3-49.

Kitchen, D.W., and P.M. Woodard. 1996. Seasonal habitat use and herd composition by Roosevelt elk in the Marble Mountains, Siskiyou County, California. Unpublished report submitted to California Department of Fish and Game, July 1996.

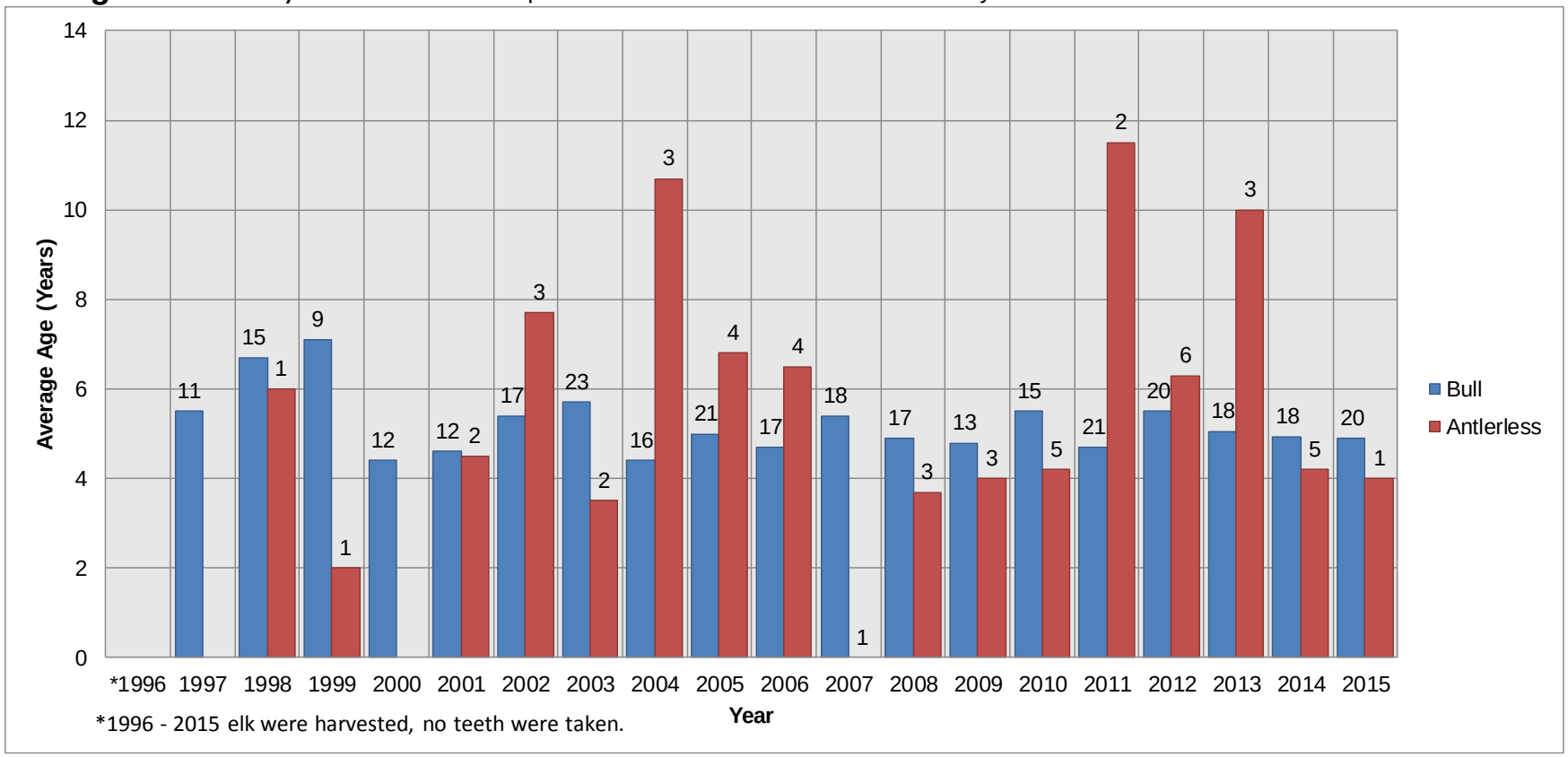
Klamath National Forest. 2007. Elk management strategy. Klamath National Forest Interagency Report. Yreka, California, USA.

Data Tables/Figures

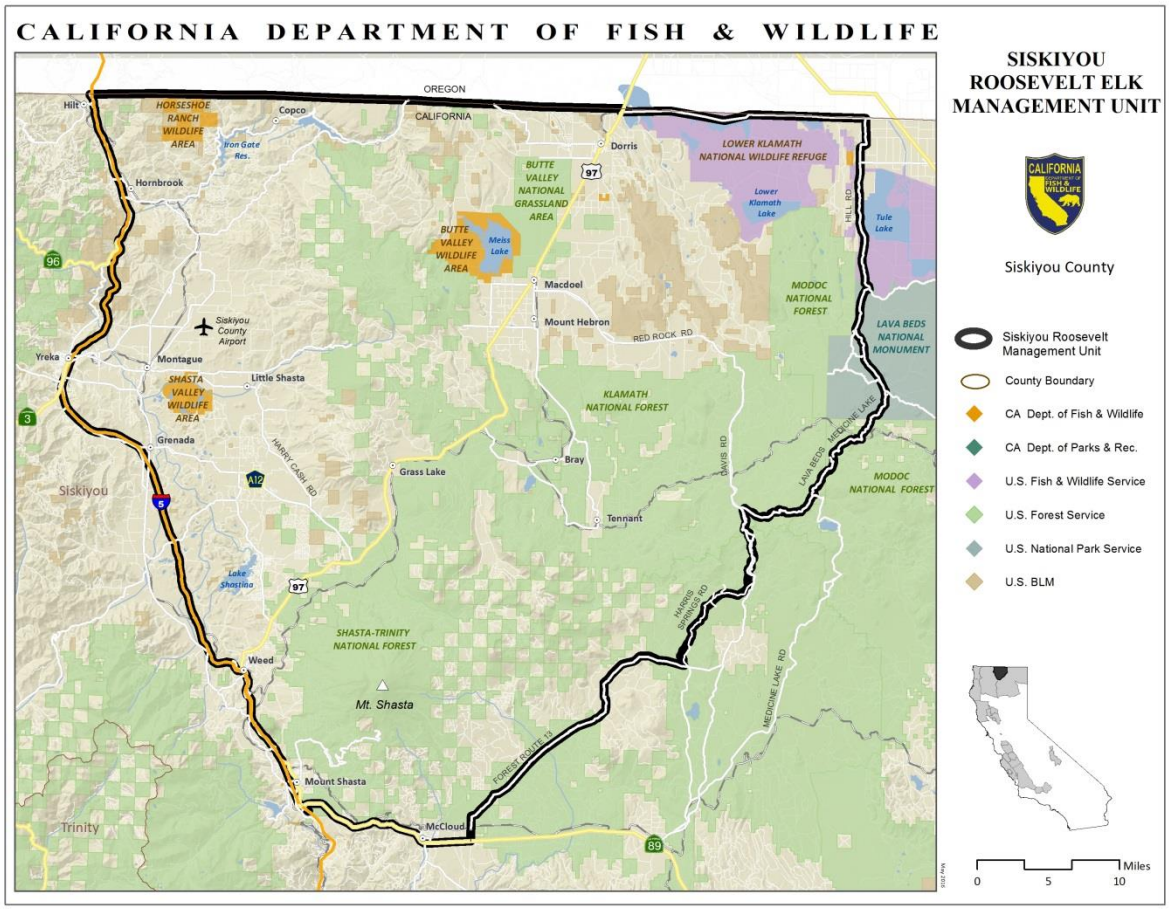
Table 1. Marble Mountains Elk Unit, Public Tag Quotas and Harvests, 1996-2016.

Year	General Either-Sex			Apprentice Either-Sex			Muzzleloader/Archery Either-Sex			Bull		Antlerless		Cooperative Elk Hunting		
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest
1996	25	15	2													
1997	25	14	1													
1998	30	18	1													
1999	30	13	1													
2000	30	14	1											1	1	
2001	30	11	3											2	2	
2002	40	19	3											3	3	
2003	40	25	2											3	2	1
2004	40	26	2											4	2	1
2005	40	22	5											5	5	
2006	38	19	5	2	1									4	2	
2007	40	24	1	2	1									5	3	
2008	40	20	3	2	0									7	0	
2009	40	17	4	2	1									6	3	
2010				2	0		5	2		35	16	10	5	6	4	
2011				2	2		5	0		35	24	10	2	6	0	
2012				2	1		5	1		35	21	10	6	4	1	
2013				2	1		5	1		35	20	10	4	4	2	
2014				1	1		5	3	2	35	16	6	5	4	4	
2015				2	2		5	0	1	35	21	10	2	4	3	
2016				2	1		5	0	2	35	23	10	7	6	4	
Totals	**488**	**257**	**34**	**21**	**11**	**0**	**35**	**7**	**5**	**245**	**141**	**66**	**31**	**74**	**41**	**2**
Success Rate	**60%**			**52%**			**34%**			**58%**		**47%**		**58%**		

Figure 1. Average age of Bull and Antlerless Elk Taken by Hunting in Marble Mountains Elk Management Unit, 1996-2015. Sample sizes are denoted above bars for each year.



Siskiyou Roosevelt Elk Management Unit



Siskiyou
Roosevelt Elk Management Unit

Description

The Siskiyou Roosevelt Elk Management Unit (Unit) is in Siskiyou County within the following boundary: beginning at the junction of Interstate Highway 5 with the California-Oregon state line; east along the state line to Hill Road at Ainsworth Corner; south along Hill Road to Lava Beds National Monument Road; south along Lava Beds National Monument Road to USDA Forest Service Road 49; south along USDA Forest Service Road 49 to USDA Forest Service Road 77; west along USDA Forest Service Road 77 to USDA Forest Service Road 15 (Harris Spring Road); south along USDA Forest Service Road 15 to USDA Forest Service Road 13 (Pilgrim Creek Road); southwest along USDA Forest Service Road 13 to Highway 89; northwest along Highway 89 to Interstate Highway 5; north along Interstate Highway 5 to the point of beginning.

The Unit is within the North Coast and Klamath, and the Cascades and Modoc Plateau Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). The Unit lies at the southern portion of the Cascade Mountain Range and is volcanic in origin. Elevation varies from 2,500 feet to more than 14,000 feet at the summit of Mount Shasta. Woodlands at higher elevations are dominated by mixed conifers, whereas lower elevations consist of oak woodlands, brushlands and agricultural pastures and fields. Other large herbivores within the Unit include mule deer (*Odocoileus hemionus*) and black-tailed deer (*O. h. columbianus*), pronghorn (*Antilocapra americana*), feral horses (*Equus caballus*), and domestic livestock.

The Unit encompasses 1.3 million acres with approximately half of the Unit consisting of public land administered by the United States Department of Agriculture Forest Service (USFS; Klamath and Shasta National forests), the United States Department of Interior Bureau of Land Management (BLM), and to a lesser extent, United States Fish and Wildlife Service (USFWS) and the California Department of Fish and Wildlife (Department). Private land uses include timber harvest, livestock, mining, and agricultural crop production. Some private timber land is interspersed with Forest Service and/or BLM land in a checkerboard fashion (i.e., ownership of adjacent sections alternates between public and private; privately-owned sections may not be posted, fenced/gated or otherwise distinguished from public land). While some elk are accessible on public and private timber land, elk hunting opportunity is probably greater on private land where access is limited and/or trespassing fees are required.

The Northeastern Siskiyou Road Management Plan (Peers 2011) calls for closure of certain roads to vehicular use, but allows foot traffic and hunters. While there is a

significant amount of public land within the Unit where access is good, elk densities may not be highest on public lands, particularly during the hunting season.

Recreational activities involving elk include hunting, photography, wildlife viewing, nature study and shed collecting. In some years, a significant portion of the elk harvest occurs on private land with access fees. Non-consumptive uses of elk probably exceed consumptive use.

Elk Distribution and Abundance

The Unit is located at the eastern edge of historical Roosevelt elk (*Cervus canadensis roosevelti*) range where overlap with Rocky Mountain elk (*Cervus canadensis nelsoni*) was thought unlikely (Murie 1951, Graf 1955, Harper et al. 1967). However, based on museum specimens, McCullough (1969) suggested that Rocky Mountain elk extended west from the Great Basin into the Mount Shasta region, indicating a likely potential for overlap of subspecies within the Unit. Recent genetic testing suggests that, due to modern translocations, it may no longer be possible to determine the historical overlap of Roosevelt and Rocky Mountain elk, as the Unit currently contains both subspecies and their hybrids (Meredith et al. 2007).

The decimation of elk populations in California has been attributed to non-indigenous human settlement of the state (Harper et al. 1967, McCullough 1969). In modern times, Harper et al. (1967) described a core area of remaining Roosevelt elk in northwestern California and acknowledged reports from other areas to the east. Elk sightings were reported in the 1960s were attributed to natural dispersal from expanding populations in southern Oregon. Additionally, Rocky Mountain elk were released near Shasta Lake in the early 1900s and Roosevelt elk were released at several sites in Siskiyou and Trinity counties beginning in the 1980s; these activities may have contributed to dispersal of elk into this Unit. In 1982, the Department began to monitor elk distribution within the Unit to identify key areas of use. Currently, elk concentrate in two distinct winter areas approximately 20 miles apart. Some elk may use both winter areas and it is likely that a high degree of interchange occurs on summer and transition ranges. These areas are briefly discussed below.

Shasta Valley Winter Area. These elk mostly range from the eastern foothills of Shasta Valley, north to Klamath River, then south and east to Deer Mountain. They spend most of the winter on private ranches in the Shasta Valley. The gentle slopes from Eagle Rock to the Klamath River above Copco Lake offer many patches of oak woodlands and grasslands. In the spring, the elk move south and east transitioning to their summer ranges around Grass Lake, Bull Meadows and Deer Mountain. They may also range east of Highway 97 in the Long Prairie and Round Valley areas. Some animals from this subherd have moved into Oregon periodically; others have moved long distances eastward into the Northeastern unit.

Butte Valley Winter Area. Winter range primarily consists of private lands and uplands immediately adjacent to the valley floor on the north, west, and south sides of Butte Valley; an area that is described by drier eastside pine or juniper woodland habitats. Elk make elevational shifts to private agricultural lands or surrounding mountains administered by the USFS in the summer. Summer range around McGavin Peak includes mixed conifer and true fir communities interspersed with small glades associated with riparian areas. Elk from this subherd also move north into Oregon or east into the Northeastern unit periodically.

The Department has conducted periodic ground, fixed wing, and helicopter surveys to monitor elk within the Unit (Table 1). Based on these surveys, anecdotal observations, and current trends in harvest, the Unit contains approximately 1,000 elk. Population density is believed to be low compared to some adjacent California units and populations in Oregon. Despite the limited information describing demography and distribution, it appears that suitable unoccupied habitat exists within the Unit and there is potential for expansion of elk range.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 4) alleviate human-elk conflicts. Specific objectives for each goal and actions recommended to assist with achievement of each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The Department considers the elk population to be increasing and has not reached the upper population identified in Objective 1.7. Previous systematic population monitoring throughout the Unit has not occurred. In 2015, the Department hired dedicated staff to implement an elk monitoring and research program for this Unit. This effort is examining distribution and abundance of elk groups to help guide population and habitat management activities. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Population management for this Unit includes efforts to increase elk numbers, where suitable, on public lands while working to reduce or stabilize elk numbers in conflict

areas. It will involve a conservative level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict, and targeted elk hunting and depredation relief in areas where reoccurring conflict with agriculture and humans exists.

Currently, elk appear to utilize private lands disproportionate to their availability that, in some areas, causes conflict with landowners. Expanding of elk on private lands where their presence is tolerated is one method to successfully increase the populations. Such private lands include timberlands, ownerships enrolled in the PLM or SHARE programs, and other properties where landowners desire elk. Where suitable unoccupied elk habitat exists, management actions should facilitate natural dispersal or translocations to reestablish elk where conflicts will be minimal.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with federal, state, and local agencies, Tribes, and private landowners.

Objective 1.1. Continue and complete monitoring projects to determine population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue to affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to determine seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2022.

Action 1.1.2
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% by 2028 in areas where human-elk conflicts are expected to be minimal.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Action 1.2.3
Coordinate with public land agencies, Tribes, and NGOs and establish a timeline to evaluate the potential for elk translocations. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, California Department of Transportation and Fire Protection, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance oak woodlands, montane prairies, and other elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.5
Collaborate with the Klamath National Forest (KNF) to identify and implement strategies to conserve and enhance sensitive habitats that are important to ungulates. Expected completion: 2023.

Action 1.3.6
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2023.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2021.

Action 1.4.2
Quantify wolf predation and determine potential impacts on elk population levels. Expected completion: 2023

Objective 1.5. Collaborate with the California Department of Transportation (CalTrans) to provide information and recommendations to reduce vehicle collisions along the Highway 97 corridor by 2023.

Action 1.5.1
Examine existing GPS collar and elk survey data to assist in determining elk use along the Highway 97 corridor. Expected completion: 2021.

Action 1.5.2
Utilize collar and survey data from newly implemented projects to obtain additional data on elk presence and mortality along Highway 97 corridor. Expected completion: 2023.

Action 1.5.3
Provide recommendation to CalTrans for management actions to reduce vehicle collisions along Highway 97 corridor. Expected completion: 2023.

Objective 1.6. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.6.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.6.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.6.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.7. Maintain a population of 600-2,000 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.7.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.7.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes.

Identified issues include; the need to assess the number and composition of elk populations utilizing tribal lands; the need for habitat restoration; the significance of potential limiting factors affecting elk management; the potential for translocation of elk onto tribal land; and regulation of hunting, among others. The Department is committed to working with Tribes on enhancing elk habitat.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes to develop co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Objective 2.2. Work with Tribes to complete monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat by 2023.

Action 2.2.1
Collaborate with interested Tribes to identify monitoring and habitat projects and establish a timeline for implementation. Expected completion: 2019.

Action 2.2.2
Coordinate with interested Tribes to identify Department approved research projects utilizing GPS collars to assess habitat use. Expected completion: 2023.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One strategy is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts and reduce hunting pressure on elk inhabiting public lands.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits. Other projects to improve public hunting access on private land have yet to be

implemented within the Unit, but as additional landowners learn about the SHARE program, public access opportunities for elk hunting may increase.

Objective 3.1. Increase elk hunting opportunities by 10% by 2023, where feasible and compatible with population objectives.

Action 3.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 3.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Action 3.1.3
Increase elk hunting opportunities on USFS and BLM holdings when appropriate. Elk hunting opportunities should occur at a level that does not inhibit maintenance and expansion of the elk population on public land. Ongoing.

Objective 3.2. Conduct an elk workshop to inform the public about elk and elk viewing opportunities by 2023.

Action 3.2.1
Work with agencies, academia, and NGOs to provide information on elk and elk viewing at the workshop. Expected completion: 2020.

Objective 3.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.3.1
Work with agencies, academia, and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Management actions are currently needed in some areas of the Unit where private property conflicts occur and elk populations are increasing.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where

substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve tolerance of elk on their properties. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting and co-management with Tribes to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

Objective 4.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 4.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 4.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Elk have been documented within the Unit for over 45 years and a conservative hunting program has been in place for more than 25 years. The population appears to be increasing. Monitoring of elk equipped with GPS transmitters confirms that individuals and small groups have moved between the Siskiyou and Northeastern California units, as well as between the Siskiyou unit and elk units in southern Oregon. Such monitoring indicates the potential for genetic exchange between adjacent elk herds. Elk in this Unit are highly mobile, which facilitates a high rate of gene flow and is a potentially important characteristic for a viable elk population. Monitoring of hybridization with other subspecies of elk should be continually monitored.

Summary of Annual Harvests

The Fish and Game Commission first authorized annual public elk hunting within the Unit in 1986 (Table 2). Cooperative Elk Hunting tags became available in 2000 to qualified landowners or their designees. Elk hunting has been limited under the PLM program in this Unit; however, additional landowners have expressed interest and additional applications are expected.

Tags within the Unit were designated either-sex tags to optimize hunter opportunity. The cumulative harvest disproportionately favored bulls. In 2004, the Department expanded the hunt zone boundaries and designated tags as antlerless tags or either-sex to encourage the take of females and reduce hunting pressure on mature bulls. Finally, in 2010, the Department designated tags as antlerless and bull tags.

Mean age of hunter harvest antlered and antlerless elk ranged from 2.2-6.0 years and <1.0-9.2 years, respectively (Figure 1). Mean elk age was determined by analyzing cementum annuli of tooth samples taken from harvested elk within the Siskiyou Unit.

Concerns have been expressed in the past about a possible decline in the number of mature bulls within the Siskiyou Unit. It is difficult to reliably establish statistically valid age trends through time with low sample sizes. Table 2 and Figure 1 do not indicate that historical or current harvest levels have adversely affected the elk population. The Department will continue to monitor harvest within the Unit to ensure that mature bulls are retained in sufficient numbers to maintain herd health and population resilience.

Unit Highlights

The Department has collaborated with land management agencies and NGOs to implement research and management activities. Below is a partial listing of these activities:

- From 1982-1984, the Department collaborated with Humboldt State University and the Klamath National Forest (KNF) to monitor elk distribution and abundance north of Highway 97 in the Grass Lake area. In 1983, VHF radio transmitters were attached to cow elk to monitor movements.

- Subsequently, the Department supported and conducted GPS and radio-telemetry monitoring of elk in Shasta Valley and west of Highway 97 in Butte Valley to monitor distribution and movement.

- The KNF Elk Management Strategy (2007) involved a collaborative effort between the Department, Rocky Mountain Elk Foundation, and KNF to guide and improve management of elk habitat on KNF lands.

- RMEF has undertaken the Siskiyou Elk Initiative, which has secured conservation easements for critical elk winter range within the Siskiyou Unit. Conservation easements are an important management tool to alleviate depredation and/or private property conflicts and contribute to the long-term conservation of elk.

- From 2015-2017, the Department outfitted 26 adult elk with GPS collars and 18 calves with VHF devices.

A number of studies undertaken by universities involving elk and elk habitat have been submitted to the Department. A partial list of these includes the following:

Unit Specific Research

Di Orio, Aaron P. 2004. Validation of a habitat suitability model for elk (*Cervus elaphus*) in Northern California with the use of GPS telemetry collars. Thesis, Humboldt State University, Arcata, California, USA.

Fischer, J.K. 1987. Elk habitat use and group size in the Grass Lake area of Siskiyou County, California. Thesis, Humboldt State University, Arcata, California, USA.

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Data Tables/Figures

Table 1. Elk Population Surveys for the Siskiyou Elk Management Unit, 1982 - 2017.

Year	Observed Composition Ratios			Notes
	Bulls: Cows	Calves: Cows	Total # Elk Observed	
1984	35 : 100	23 : 100	**497***	Source: Fischer and Kitchen, 1984. Siskiyou County Elk Study. Final Report, 1982-1984.
1989			**136**	Source: Department of Fish and Game, 1990. Final Environmental Document Regarding Elk Hunting. April 20, 1990.
1991	35 : 100	37 : 100	**108**	Source: Department of Fish and Game, 1991. Final Environmental Document Regarding Elk Hunting. April 25, 1991.
1992			**85**	Source: Department of Fish and Game, 1993.Final Environmental Document Regarding Elk Hunting. April 22, 1993.
1993	37 : 100	31 : 100	**99**	Source: Department of Fish and Game, 1994. Final Environmental Document Regarding Elk Hunting. April 28, 1994.
1994	24 : 100	28 : 100	**103**	Source: Department of Fish and Game, 1996. Final Environmental Document Regarding Elk Hunting. April 10, 1996.
1995	13 : 100	27 : 100	**108**	Source: Department of Fish and Wildlife Files, Sacramento, CA.
1996	10:100	21 : 100	**157**	Source: Department of Fish and Wildlife Files, Sacramento, CA.
1997	21 : 100	26 : 100	**134**	Source: Department of Fish and Game, 1998. Final Environmental Document Regarding Elk Hunting. April 14, 1998.
July 2016	11:100	39:100	**127**	Source: Department of Fish and Wildlife Files, Sacramento CA. Ground survey of East Shasta herd.
Aug 2016	10:100	40:100	**123**	Source: Department of Fish and Wildlife Files, Sacramento CA. Ground survey of East Shasta herd.
March 2017	6:100	22:100	**129**	Source: Department of Fish and Wildlife Files, Sacramento CA. Helicopter survey of East Shasta herd.
March 2017	10:100	35:100	**125**	Source: Department of Fish and Wildlife Files, Sacramento CA. Camera survey of Long Prairie herd.

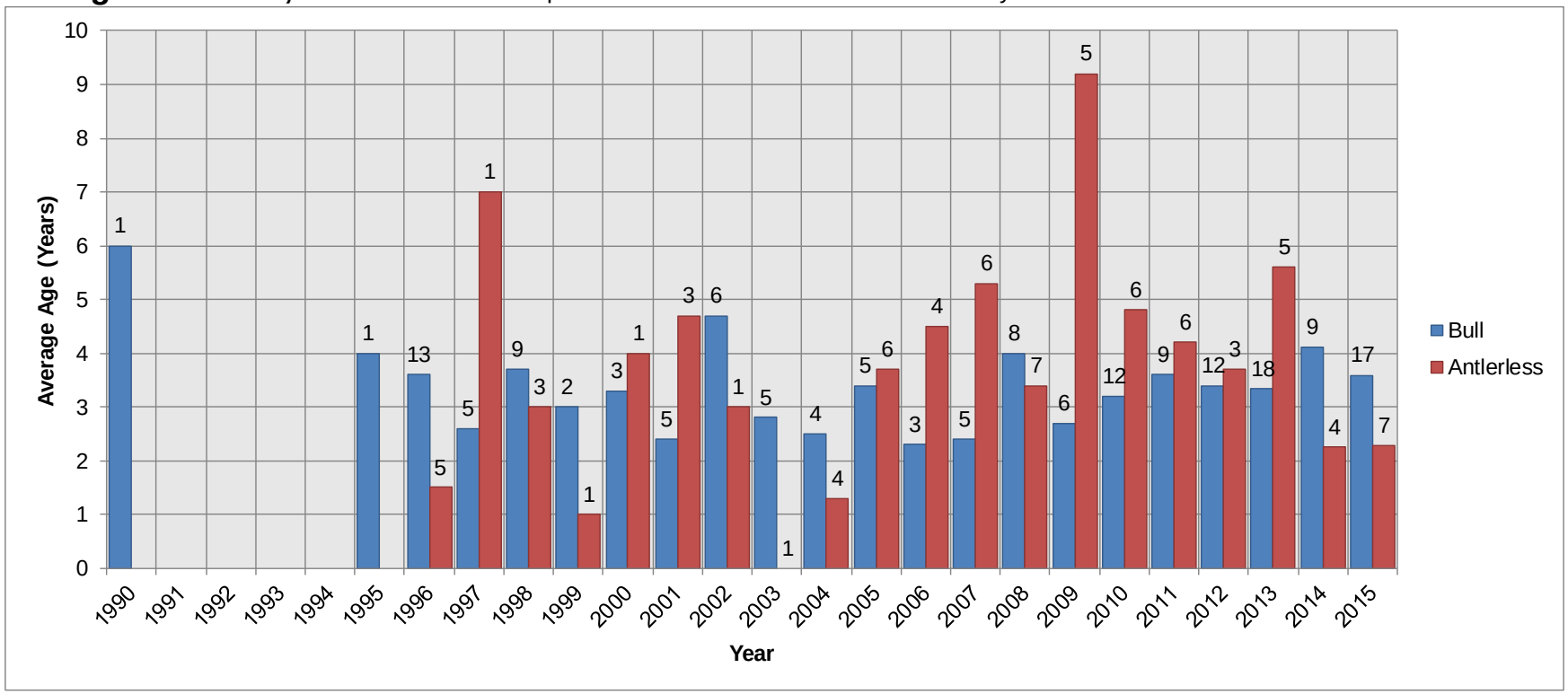
Methods included fixed-wing, helicopter and ground surveys. Results from 1982-1984 were based primarily on ground composition counts. Results from 1989-1997 were based on air and ground counts completed during winter months.

* Observed composition ratios were based on observations of multiple groups of elk over an extended period of time and most certainly included replicate observations of elk groups/individuals. The reported bull to cow ratio was based on 59 groups of elk observed from 1982-1984, whereas the calf to cow ratio was based only on compositions from sightings that occurred from late-February through May of 1983 and 1984.

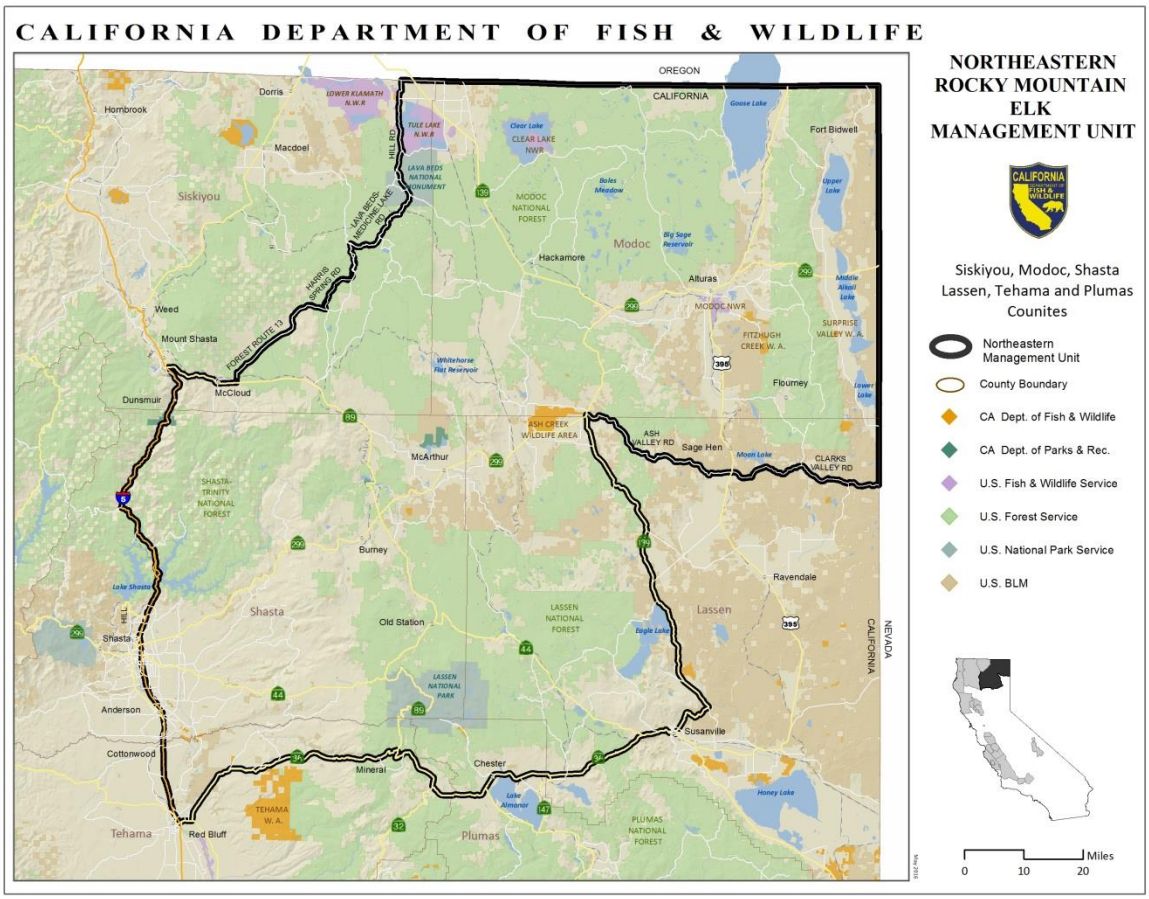
Table 2. Siskiyou Elk Management Unit, Tag Quotas and Harvests, 1986-2016.

	Either-Sex			Bull		Antlerless		Cooperative Elk Hunting		
Year	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Bull Harvest	Tags Issued	Antlerless Harvest	Tags Issued	Bull Harvest	Antlerless Harvest
1986	10	1	2							
1987	21	5	6							
1988	20	1	0							
1989	20	4	4							
1990	20	2	0							
1991	20	5	5							
1992	20	2	0							
1993	20	11	0							
1994	20	4	8							
1995	20	8	0							
1996	25	15	2							
1997	25	8	1							
1998	25	10	3							
1999	25	4	1							
2000	25	8	3							
2001	25	7	1						1	2
2002	25	5	1						2	0
2003	25	7	1						1	0
2004	15	4	0			15	4	6	0	0
2005	15	7	1			15	4	6	2	1
2006	15	7	2			15	6	6	1	1
2007	15	8	3			15	6	6	3	2
2008	15	8	0			15	6	6	1	2
2009	15	8	0			15	5	6	3	2
2010				15	12	15	5*	6	0	1
2011				15	13	15	7	6	1	1
2012				20	12	20	5	8	4	0
2013				20	18	20	10	7	2	2
2014				20	12	20	5	8	3	2
2015				20	16	20	7	8	4	0
2016				20	13	20	4	8	3	2
Totals	**481**	**149**	**44**	**130**	**96**	**220**	**69**	**87**	**31**	**18**
Success Rate	**40%**			**74%**		**31%**		**56%**		

Figure 1. Average Age of Hunter Harvested Antlered and Antlerless Elk within the Siskiyou Elk Management Unit, 1990 - 2015. Sample sizes are denoted above bars for each year.



Northeastern Rocky Mountain Elk Management Unit



Northeastern
Rocky Mountain Elk Management Unit

Description

The Northeastern Rocky Mountain Elk Management Unit (Unit) includes Modoc County and parts of Siskiyou, Lassen, Plumas, Butte and Shasta counties. Its boundary is as follows: beginning in Siskiyou County at the junction of the California-Oregon state line and Hill Road at Ainsworth Corner; east along the California-Oregon state line to the California-Nevada state line; south along the California-Nevada state line to the Tuledad-Red Rock-Clarks Valley Road (Lassen County Roads 506, 512 and 510); west along the Tuledad-Red Rock-Clarks Valley Road to Highway 395 at Madeline; west on USDA Forest Service Road 39N08 to the intersection of Highway 139/299 in Adin; south on Highway 139 to the intersection of Highway 36 in Susanville; west on Highway 36 to the intersection of Interstate 5 in Red Bluff; north on Interstate 5 to Highway 89; southeast along Highway 89 to USDA Forest Service Road 13 (Pilgrim Creek Road); northeast along USDA Forest Service Road 13 to USDA Forest Service Road 15 (Harris Spring Road); north along USDA Forest Service Road to USDA Forest Service Road 77; east along USDA Forest Service Road 77 to USDA Forest Service Road 49; north along USDA Forest Service Road 49 to Lava Beds National Monument Road; north along Lava Beds National Monument Road to Hill Road; north along Hill Road to the point of beginning.

The Unit is within the North Coast and Klamath, Cascades and Modoc Plateau, and Central Valley and Sierra Nevada Provinces, as identified in the California Statewide Action Plan (California Department of Fish and Wildlife 2015). The largest in the state at over 6.7 million acres, the Unit consists of diverse habitats and vegetation shaped by volcanic activity and climate conditions. Because of its large size, diverse topography, and vegetation the Unit includes four elk subherd areas described separately under the Elk Distribution and Abundance heading.

Approximately 55% of the Unit is public land administered by the United States Department of Agriculture, Forest Service (USFS; Klamath, Modoc, Lassen, Plumas, and Shasta National forests); Bureau of Land Management's (BLM: Applegate and Eagle Lake Field Offices); and to a lesser extent the United States Fish and Wildlife Service, Department of Defense, State Lands Commission, and the California Department of Fish and Wildlife (Department). Recreational activities involving elk within the Unit include viewing, nature study, photography, and shed collecting, and to a lesser extent hunting. Private land uses include timber, livestock, agricultural crop production, and urban development. Some private timberland is interspersed with USFS and/or BLM land in a checkerboard pattern.

Elk Distribution and Abundance

Historical accounts and museum specimens confirm that elk inhabited northeastern California prior to European arrival, but the record is insufficient to determine whether it was the Roosevelt (*Cervus canadensis roosevelti*) or Rocky Mountain (*C. c. nelsoni*) subspecies. Murie (1951) reported that much of the Great Basin may have been unoccupied by elk, including the extreme eastern portion of California, however, Murie included northeastern California within historical *roosevelti* range. Harper et al. (1967) stated that distribution of *roosevelti* and *nelsoni* did not overlap, except possibly in British Columbia and northern Washington (also see Murie 1951, Graf 1955). Other researchers reported that historical *roosevelti* range in California extended east to the Mt. Shasta area (Townsend 1887, Merriam 1899, Graf 1955, Harper et al. 1967). However, McCullough (1969) noted that museum specimens from northeastern California more resembled *nelsoni* than *roosevelti*. McCullough (1969) speculated that *nelsoni* inhabited the Mt. Shasta area during pristine times, and eastward into the Great Basin where local conditions were favorable. Murie (1951) concluded that the historical record "…cannot be complete" and more extensive data would likely show a wider distribution of elk, particularly "…at the boundaries of the mapped ranges."

It is unfeasible, if not impossible, to determine today which subspecies originally inhabited northeastern California. Such a determination would be of little management value because of translocation efforts in the late 1800s that released *nelsoni* at multiple locations. The Shasta Lake subherd was reestablished in 1913 by the Redding Elks Club when 50 *nelsoni* subspecies were loaded into railroad boxcars in Gardner, Montana, and transported to Shasta County. The *nelsoni* subspecies has also been moved to multiple locations in Oregon and Washington (Murie 1951, Robbins et al. 1982). Since 1985, the Department has captured more than 250 *roosevelti* subspecies in western Oregon and released them in Siskiyou and Trinity counties within the Unit. Both subspecies can travel great distances and could hybridize on shared range. Microsatellite analysis of samples from northeastern California elk, collected between 1997 and 2003, showed that the population contains *roosevelti*, *nelsoni*, and their hybrids (Meredith et al. 2007). As is true of other species at their range boundary, elk probably were found at relatively low densities in this region, where local conditions were suitable.

Elk were reestablished near Shasta Lake by translocation, but were not reintroduced to other locations within the Unit where they became established by natural dispersal from herds in northern California and Oregon. The elk population density is low compared to other Units in California and other states. Portions of the Unit appear suitable for elk, but are either unoccupied or occupied by transient elk. The Department estimates the Unit contains more than 1,000 elk, however this is not based upon systematic surveys. Previous monitoring is inadequate to indicate recent population trends.

The Northeastern Unit contains four general subherds, described as follows:

Shasta Lake Subherd. These elk occupy that portion of Shasta County east of Interstate Highway 5, and generally south of Highway 299. Elk are concentrated near Palo Cedro and Shingletown/Viola, with transients near Oak Run and Whitmore. Predominant habitat types include Blue Oak-Foothill Pine, Sierran Mixed Conifer, Montane Hardwood-Conifer and Montane Hardwood. Elevations range from 800 feet on the western edge to over 10,000 feet at Mount Lassen. Topography is steep in the creek canyons and on some of the higher elevation slopes. The western portion (Palo Cedro) is relatively flat open oak woodlands with brushy creek bottoms, and is mostly privately-owned, family ranches which allow minimal public access (hunting clubs or family hunting/recreation). The eastern portion is dominated by mixed conifer vegetation, with some hardwoods and brush fields. Much of the eastern portion is private industrial timber land (owned by Sierra Pacific Industries, Roseburg Resources Company, Fruit Growers Supply Company and lands managed by Beaty and Associates), with some public land administered by Lassen National Forest. No systematic population estimate has been derived; this herd contains approximately 80-200 animals. Recent anecdotal information and Department annual wildlife surveys suggest an increase in the elk population in the Palo Cedro area.

Warner Mountains Subherd. These elk occupy the extreme northeastern part of California, east of Highway 395. The Warner Mountains is a north-south running Great Basin mountain range that extends from northeast Lassen County into southeastern Oregon. Eagle Peak, within the south Warner Mountains Wilderness, is the highest peak in the range at 9,892 feet. The west slope is relatively gently sloped with a mix of lodgepole pine *(Pinus contorta)*, white fir *(Abies concolor)*, western white pine *(P. monticola)*, ponderosa pine *(P. ponderosa)* and other conifers. The east slope overlooks the Surprise Valley in California and the Warner Valley in Oregon and is characterized by rugged, rocky terrain and sparse vegetation. Most of the Warner Mountains is public land administered by the Modoc National Forest.

No systematic population estimate has been derived, but the Warner Mountains are estimated to contain 200 elk, most of which are distributed in the northern end of the Warner Mountains. The Department has received reports of sightings in central and southern portions of the Warner Mountains, and south of the South Warner Wilderness Area. Elk sign was found in aspen stands during recent research in the south Warners, and a few elk have been seen in the Delta, Bayley, and Graven Reservoir areas. These elk could have come from the Devil's Garden subherd which would indicate that elk are slowly expanding their range in the Warner Mountains.

Devil's Garden Subherd. Located north of Alturas and west of Highway 395 within the Devil's Garden Ranger District of the Modoc National Forest, available habitat consists of approximately 570,000 acres (476,000 public) of relatively flat, rocky terrain that supports juniper woodlands, sagebrush flats, and isolated stands of lodgepole and ponderosa pines, and a mix of other conifers. Vehicle access is good unless

precipitation makes travel on secondary roads difficult. The Modoc National Forest is in the process of identifying roads to be closed to ATV use.

The Department receives anecdotal accounts of elk throughout the Devil's Garden and Doublehead Ranger Districts, and elk sign and sightings are frequent. Past telemetry work conducted by the Department showed consistent elk use of the Whitehorse Mountains west of Whitehorse Reservoir. The area contains approximately 200 elk; however, as with other subherds in the Unit, no systematic population estimate has been derived. In 2016, the Department issued a grant to RMEF to conduct ground counts and estimate cow:calf ratios utilizing infrared video cameras in portions of the Unit.

Pondosa Subherd. The general area for the Pondosa subherd is located in southeastern Siskiyou and northeastern Shasta counties, extending from northeast of the town of McCloud, south to the town of Burney. Typical habitat types include Sierran Mixed Conifer, Ponderosa Pine and Montane Hardwood – Conifer. Topography is relatively flat, but gradually transitions to steeper slopes near the creeks. There are several large meadows in the region, with aspen/willow communities that provide cover and foraging areas for elk. Large tracts are private ranches, or owned by private timber companies (Roseburg Resources Inc. and Sierra Pacific Industries) which may restrict vehicle access. There is good access to land administered by the Shasta–Trinity National Forest. This subherd may contain more than 250 animals, with the majority residing in the Pondosa area and several smaller concentrations near the towns of Burney and Cassel.

The Department has surveyed and monitored elk within the Unit using VHF and GPS telemetry methods. In 1990, staff attached VHF transmitters to cow elk in Shasta County (Flueck and Smith-Flueck, 1992). In 1993, staff attached VHF transmitters to one bull and cow elk from the Warner Mountains and Devil's Garden areas to monitor movements and identify key areas of use (Ratcliff 1994). In 1999, staff attached GPS transmitters to elk in Modoc and Siskiyou counties for subsequent monitoring (Di Orio 2004). In February 2008, VHF and GPS transmitters were attached to bull and cow elk from the Shasta Lake subherd. GPS location data from those elk indicated that they were mostly resident with the bull making an altitudinal migration in the summer, only to return as soon as breeding season began. An additional animal was fitted with a GPS and VHF collar in March of 2010, in the Burney area, but the GPS collar was not recovered. In 2015, a pilot study with RMEF and Roseburg Resources Inc. was initiated utilizing wildlife cameras to monitor elk populations within the Pondosa area. Preliminary results indicate calf/cow ratios of approximately 53 calves per 100 cows with a 90% confidence interval of the 275 elk classified (Table 1). A helicopter survey was also completed in 2015 and focused on areas within and around the Modoc National Forest. This was a cooperative project with RMEF and the USFS. Road and helicopter counts were conducted by the Department in 2016 and 2017 (Table 1).

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 4) alleviate human-elk conflicts. Specific objectives and actions recommended to achieve each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The Department considers the elk population to be increasing and has not reached the upper population identified in Objective 1.7. Previous population monitoring data was not collected across the Unit. In 2015, the Department hired dedicated staff to implement an elk monitoring and research program for this Unit in an effort to examine distribution and abundance of elk groups that will help guide population and habitat management activities. The objective is to maintain or improve elk habitat conditions. Forage and cover requirements of elk are generally well known. However, these features are largely undescribed for the Unit, and only limited telemetry studies have been conducted at specific locations. The Department should work to ensure appropriate quantity and distribution of cover and forage habitats to support the existing elk population, and allow dispersal/expansion, especially onto public lands. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Population management for this Unit includes efforts to increase elk numbers where suitable on public lands. This will involve a conservative level of regulated elk hunting to promote natural range expansion and population growth towards the upper population objective in areas without conflict.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects within forested communities, can promote a mix of habitat types and successional stages, including forest openings and meadows that benefit elk. To achieve these objectives, the Department will collaborate with state and federal agencies, Tribes, and private landowners.

Objective 1.1. Continue and complete projects to estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2022.

Action 1.1.2
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% by 2028 in areas where human-elk conflicts are expected to be minimal.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, California Department of Forestry and Fire Protection, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance oak woodlands, and other elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.5
Provide Private Lands Management (PLM) operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Action 1.3.6
Collaborate with the USFS to identify and implement strategies to conserve and enhance sensitive habitats that are important ungulates. Expected completion: 2023.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2023.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2021.

Action 1.4.2
Quantify wolf predation and determine potential impacts on elk population levels. Expected completion: 2023

Objective 1.5. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Use genetic monitoring results and GPS collar data to identify and prioritize areas for habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Determine habitat relationship between elk, livestock, and feral horses by 2028.

Action 1.6.1
Collaborate with BLM, USFS, and academia on relationships between elk, livestock, and feral horses on summer and winter ranges. Expected completion: 2025.

Action 1.6.2
Provide recommendation to BLM, USFS, and ranchers for management actions to reduce conflicts between elk, livestock, and feral horses. Expected completion: 2023.

Objective 1.7. Maintain a population of 1,000-3,500 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.7.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population. Ongoing.

Action 1.7.2
Review data on an annual basis and adjust population objectives as more information is collected through monitoring, management, and research. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes.

Identified issues include; the need to assess the number and composition of elk populations; the need for habitat restoration; the significance of potential limiting factors affecting elk management. The Department is committed to working with Tribes on enhancing elk habitat.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes to develop co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Objective 2.2. Work with Tribes to complete monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat by 2023.

Action 2.2.1
Collaborate with interested Tribes to identify monitoring and habitat projects and establish a timeline for implementation. Expected completion: 2019.

Action 2.2.2
Coordinate with interested Tribes to identify Department approved research projects utilizing GPS collars to assess habitat use. Expected completion: 2023.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. This Unit is large and contains numerous elk groups for which different

management options may be considered in the future. This may include dividing the hunt zone into smaller units and setting tag quotas for the smaller areas/subherds. An additional option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 3.1. Increase elk hunting opportunities by 10% by 2023, where feasible and compatible with population objectives.

Action 3.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 3.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Objective 3.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.2.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve their tolerance of elk. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting and co-management with Tribes to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

Objective 4.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 4.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 4.1.4
Develop specific elk hunting boundaries (and/or sub-divide Unit into multiple elk zones) to better distribute harvest and assist in alleviating private property conflicts and localized increases in elk populations. Expected completion: 2020.

Action 4.1.5
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.6
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Elk have persisted within portions of the Unit for 100 years. A conservative hunting program has been in place for the Shasta Lake subherd for over 25 years. There is no indication of a population decline or reduction in range. The range of some subherds appears to be expanding, population numbers appear to be increasing and there is no indication that an upper limit threshold has been reached. Based on VHF and GPS transmitter monitoring, individual elk have moved between the Warner Mountains and Devil's Garden and have crossed into southern Oregon. Additionally, individuals and small groups have moved between the Northeastern and Siskiyou management units, based on GPS monitoring. A potential for genetic exchange is therefore well established and the Northeastern Elk Herd appears to be viable. The Department should continually monitor hybridization with other subspecies of elk.

Summary of Annual Harvests

Initially, the Department offered public elk hunting opportunities sporadically within a small portion of the Northeastern Unit. From 1969-1972, the Fish and Game Commission authorized 500 elk tags for a portion of Shasta and Siskiyou counties (the hunt was called the Shasta Rocky Mountain Elk Hunt and involved the Shasta Lake subherd). The hunt resumed in 1987 and continued annually through 2001 (Table 2).

In 2002, the hunt was renamed the Northeastern California Rocky Mountain Elk Hunt and boundaries were expanded significantly to provide additional public hunting opportunities within the Devil's Garden, Warner Mountains, and Pondosa subherds. Either-sex tags were designated for separate general and archery only seasons (i.e., applicants drawn for the general season could not hunt during the archery only season and vice versa). The Department established an apprentice (junior) hunt in 2006, concurrent with the general season. The hunt boundary was expanded to its current boundaries in 2010, to provide access to elk in the Palo Cedro and Viola areas.

Public quotas and harvests within the Unit from 2002-2016 are summarized in Table 3. Cooperative Elk Hunting tags became available to qualified landowners or their designees in 2000. Elk hunting in the Unit under the PLM program has been minimal. The Black Ranch has been licensed to hunt elk since 1991, and Clouds Warner Mountain Ranch was licensed to hunt elk from 2002-2009 (Tables 2 and 3).

Mean age of hunter-killed bulls from 2002-2015 is consistently at or above 4 years (Figure 1). Total sample size for antlerless elk is small, and no age trend is apparent, however harvest of antlerless elk has been minimal (Table 3), and any impact on population size is likely negligible.

Since hunt boundaries were expanded in 2002, reported harvest has disproportionately favored bulls and hunter success has been relatively high. High success and a harvest skewed towards bulls under an either-sex tag regimen may suggest that bulls are more desirable and/or vulnerable compared to antlerless elk. However, hunter success, the

take of bulls, and the average age of the harvest within the Unit have not declined since 2002 and there is no information to indicate that issuing either-sex tags has adversely affected bull numbers.

Tag designations for the Unit changed from either-sex tags in 2009 to bull and antlerless tags in 2010. This change provided additional hunting opportunities by increasing the total tag quota, without increasing hunting pressure on bulls.

Unit Highlights

The Department has collaborated with land management agencies and NGOs to monitor and manage elk that are reestablished within portions of the Northeastern Unit through natural dispersal. Below is a partial listing of these activities:

- In 1990, the Department attached VHF transmitters to cow elk in Shasta County for subsequent monitoring by contract.
- In 1993, the Department attached five VHF transmitters to elk from the Warner Mountains and Devil's Garden areas to monitor movements and identify key areas of use.
- In 1999, the Department attached GPS transmitters to elk in Modoc and Siskiyou counties for monitoring.
- Late 1990s the Department established an ad hoc working group because of concerns about elk management and elk-human conflicts.
- In February 2008, the Department attached VHF and GPS transmitters to four elk from the Shasta Lake subherd for monitoring.
- In 2015 and 2106, the Department issued a grant to RMEF to conduct ground counts and estimate cow:calf ratios utilizing infrared video cameras in portions of the Unit.
- From 2016-2017, the Department outfitted nine adult elk with GPS collars.

The Department has periodically completed aerial and ground surveys, and used VHF and GPS telemetry methods to monitor herds within boundaries of the Northeastern Elk Management Unit and has collaborated with the USFS in developing habitat improvement projects within the Unit. A partial listing of studies, reports and monitoring/management activities within the Unit is as follows:

Unit Specific Research

Modoc Elk Working Group. 2000. The greater Modoc area: a strategic plan for elk management. March 2000. Unpublished report.

Smith, D.O., and D.W. Murphy. 1973. The Shasta Lake elk herd: status and recommendations for management. Unpublished report to California Department of Fish and Game, Redding, USA.

Literature Cited:

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

Di Orio, Aaron P. 2004. Validation of a habitat suitability model for elk (*Cervus elaphus*) in Northern California with the use of GPS telemetry collars. Thesis, Humboldt State University, Arcata, California, USA.

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Graf, W. 1955. The Roosevelt elk. Port Angeles Press, Port Angeles, Washington. USA.

Harper, J.A., J.H. Harn, W.W. Bentley, and C.F. Yocum. 1967. The status and ecology of the Roosevelt elk in California. Wildlife Monographs 16:3-49.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Meredith, E.P., J.A. Rodzen, J.D. Banks, R. Schaefer, H.B. Ernest, R.R. Famula, and B.P. May. 2007. Microsatellite analysis of three subspecies of elk (*Cervus elaphus*) in California. Journal of Mammalogy 88(3):801-808.

Merriam, C. H. 1899. Results of a biological survey of Mount Shasta, California. North American Fauna 16:179.

Murie, O.J. 1951. The Elk of North America. Stackpole, Harrisburg, Pennsylvania and the Wildlife Management Institute, Washington, D.C., USA.

Ratcliff, K. 1994. Preliminary elk location study. Warner Mountains, Modoc County, California. California Department of Fish and Wildlife, Sacramento, USA.

Robbins, R.L., D.E. Redfearn, and C.P. Stone. 1982. Refuges and elk management. *In*: J.W. Thomas and D.E. Toweill, editors. Elk of North America: ecology and management. Stackpole Books, Harrisburg, Pennsylvania, USA.

Townsend, C.H. 1887. Field notes on mammals, birds and reptiles of Northern California. Proceedings of the US National Museum 10:159-241.

Data Tables/Figures

Table 1. Elk Surveys for the Northeastern Elk Management Unit, 2015-2017.

Date	Location	Number of Elk Observed					Total	Cow:Calf Ratio	Source
		Bulls		Cows	Calves	Not Classified			
		Branched	Unbranched						
June, 2015	**Egg Lake**					150	**150**		RMEF Cameras
July, 2015						408	**408**		RMEF Cameras
August, 2015						711	**711**		RMEF Cameras
September, 2015						24	**24**		RMEF Cameras, data lost due to hard drive failure
October, 2015						154	**154**		RMEF Cameras
July, 2016	**Grass Lake**	2	7	85	33	0	**127**	**39%**	CDFW Ground Count
March, 2017	**Clear Lake**	16	15	65	27	0	**123**	**42%**	CDFW Helicopter Survey
	Egg Lake	0	5	14	6	0	**25**	**43%**	CDFW Helicopter Survey

Table 2. Shasta Rocky Mountain Elk Hunt, Tag Quotas and Reported Harvests, 1969-2001.

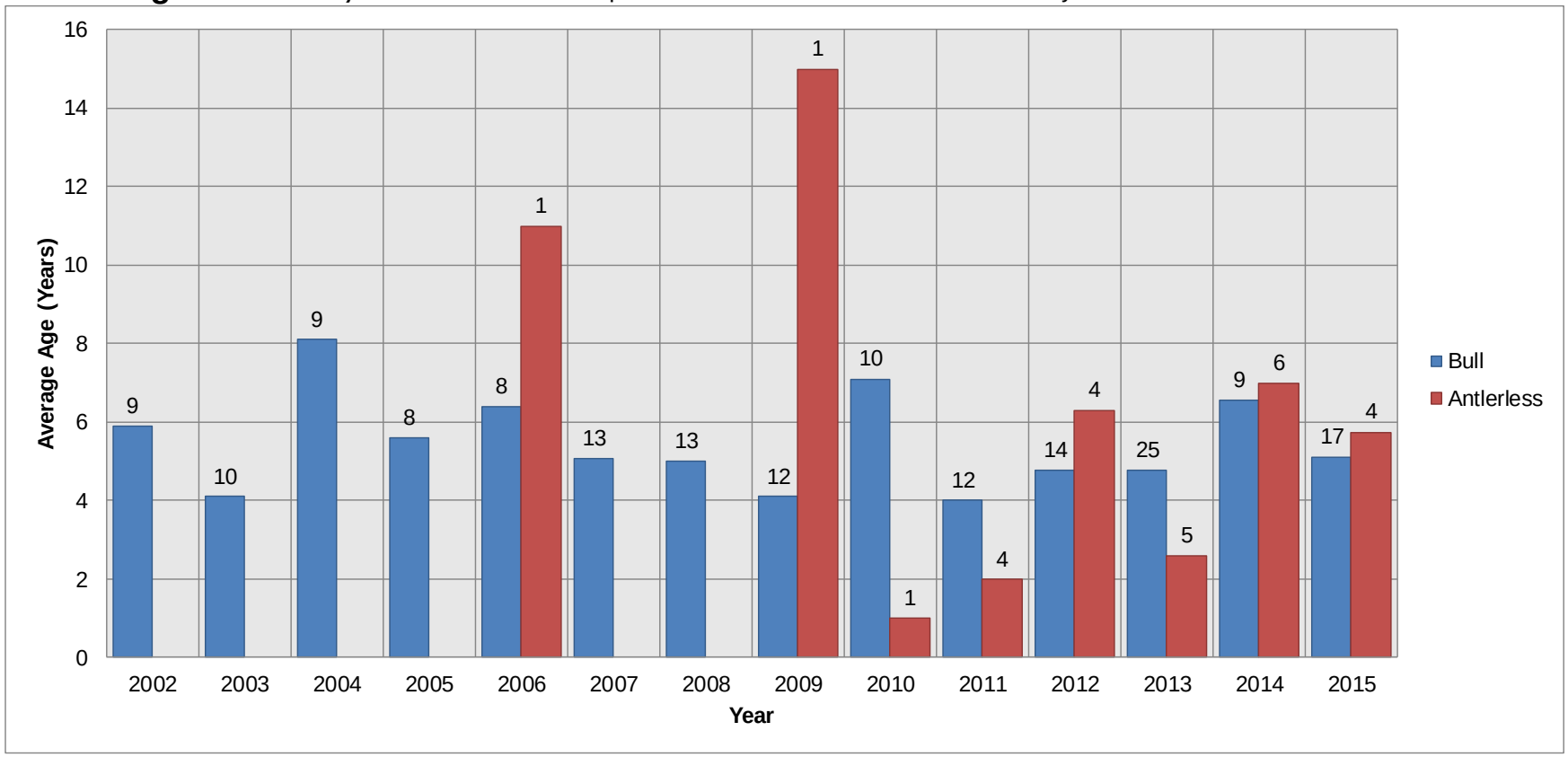
Year	General Either-Sex			Bull		Antlerless		Reported PLM Harvest		
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest
1969				65	5	35	3			
1970	100	10	11							
1971	200	4	14							
1972	100	2	1							
1987	11	3	1							
1988	10	2	3							
1989	10	2	3							
1990	10	3	1							
1991	10	2	3					3	1	
1992	5			1	1	4	1	3	1	1
1993	5			1		4	3	1	1	
1994	5			1	1	4	2	1	1	
1995	5			1	1	4	4	1	0	
1996				1	1	4	1	1	1	
1997				1	1	4	2	2	1	
1998				1	1	4	2	1	1	
1999				1	1	4	3	1	1	
2000				1		4	4	1	1	
2001				1		4	1			
Totals	**471**	**28**	**37**	**75**	**12**	**75**	**26**	**15**	**9**	**1**
Success Rate	**14%**			**16%**		**35%**		**67%**		

Note: From 1969-1972 the Shasta Hunt Zone included a portion of Siskiyou County; it was bounded by Interstate Highway 5 to the west, Highway 89 to the north and east, and Highway 299 to the south. The zone was considerably smaller from 1987-2001; in general it was bounded by Big Bend Road to the west, Pit River to the north, Highway 89 to the east, and Highway 299 to the

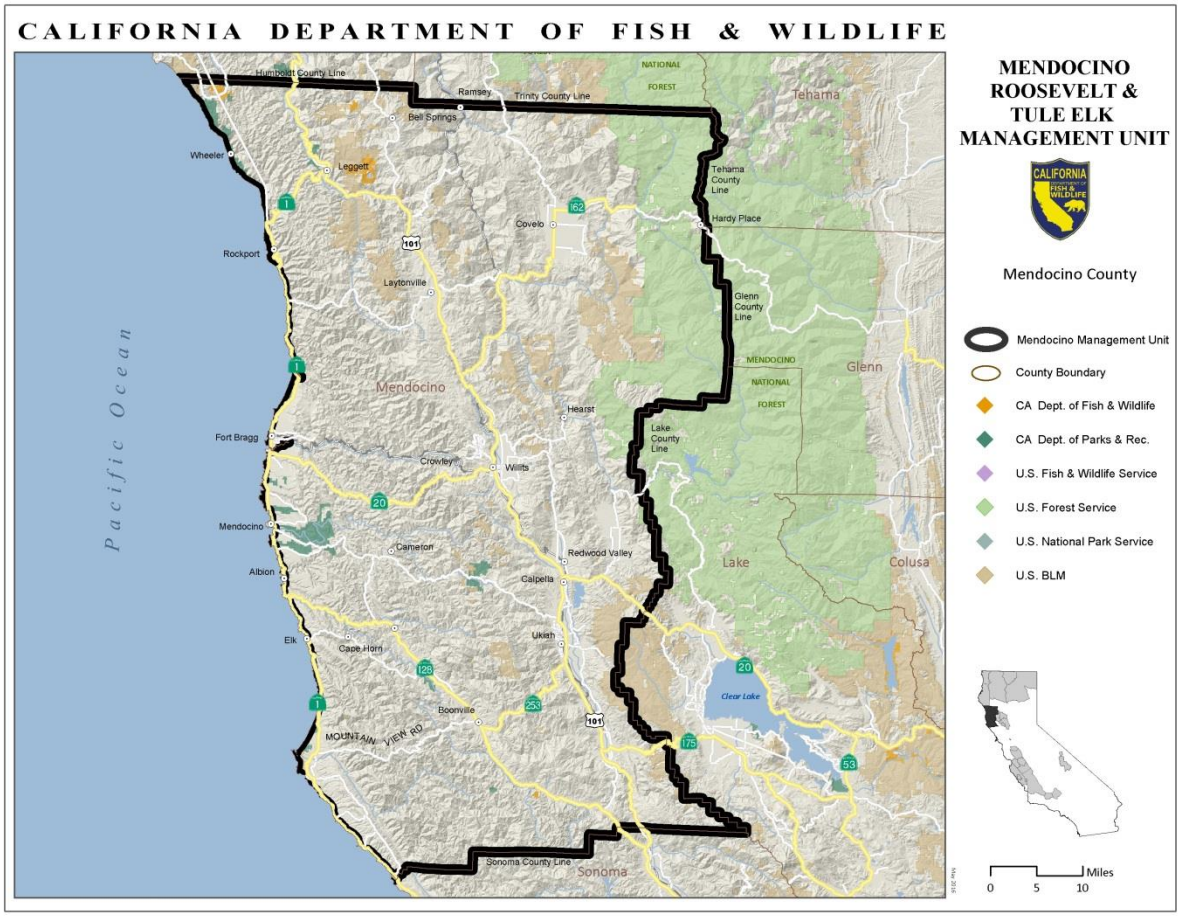
Table 3. Northeastern Elk Unit, Public Tag Quotas and Reported Harvests and Reported Private Lands Management Area Harvests, 2002-2016.

Year	General Methods Either-Sex			Bull		Antlerless		Archery Either-Sex			Apprentice Either-Sex			Cooperative Elk Hunting			Reported PLM Harvest		
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	Bulls	Antlerless	Number of Ranches
2002	10	9						5	2								0	0	2
2003	10	9						7	3					2	0	0	2	1	2
2004	10	6						7	5					2	1	0	2	1	2
2005	10	8						7	0					3	2	0	1	0	2
2006	10	6	1					7	1		2	2		3	1	0	1	1	2
2007	10	9						9	3		2	2		3	1	0	2	1	2
2008	10	8						9	4		2	1		3	1	0	1	0	2
2009	15	13	1					10	2		2	2		2	1	0	2	1	2
2010				15	10	5	1	10	1		2	1		4	1	0	1	1	1
2011				15	11	5	5	10	3		2	1		4	0	0	2	1	2
2012				15	9	10	3	10	1		2	1	1	5	2	0	4	2	3
2013				15	10	10	5	10	2		2	0	0	4	2	0	4	3	3
2014				15	7	10	6	10	1	1	2	2		6	1	1	3	3	3
2015				15	11	10	3	10	3		2	2		7	1	2	4	3	3
2016				15	10	10	5	10	2	1	2	2		7	2	2	2	2	3
Totals	**85**	**68**	**2**	**105**	**68**	**60**	**28**	**131**	**33**	**2**	**22**	**16**	**1**	**55**	**16**	**5**	**31**	**20**	
Success Rate	**82%**			**65%**		**47%**		**27%**			**77%**			**38%**					

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting within the Northeastern Elk Management Unit, 2002 - 2015. Sample sizes are denoted above bars for each year.



Mendocino Roosevelt Elk Management Unit



Mendocino
Roosevelt Elk Management Unit

Description

The Mendocino Roosevelt Elk Management Unit (Unit) occurs entirely within Mendocino County. Specific boundaries are: within a line beginning at the Pacific Coastline and the Mendocino/Humboldt County line south of Shelter Cove; east along the Mendocino/Humboldt County line to the intersection of the Humboldt, Mendocino, and Trinity County lines; south and east along the Mendocino/Trinity County line to the intersection of the Mendocino, Trinity, and Tehama County lines; south along the Mendocino County line to the intersection Mendocino and Sonoma County lines: west along the Mendocino County line to the Pacific Coastline; north along the Pacific Coastline to the point of beginning.

The Unit is within the North Coast and Klamath Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). It is a system of north and northwest-trending mountains and valleys. Elevation extends from sea level to 6,954 feet at Anthony Peak. Summer temperatures can exceed 95° F at inland locations, and in winter freezing temperatures occur in many areas. Annual precipitation varies from 45 to 80 inches.

Vegetation is dominated by redwood, Douglas-fir, and mixed coniferous forests. Forests cover over 50% of the county. Woodlands and savannahs comprise 15% of the county and include taxa such as California black oak (*Quercus douglasii*), Oregon oak (*Quercus garryana*), alder (*Alnus* spp.), dogwood (*Cornus* spp.), Oregon ash (*Fraxinus latifolia*), bigleaf maple (*Acer macrophyllum*), buckeye (*Aesculus californica*), poison oak (*Toxicodendron diversilobum*), manzanita (*Arctostaphylos* spp.), *Ceanothus*, chamise (*Adenostoma fasciculatum*), currant (*Ribes* spp.), blackberry (*Rubus* spp.), and annual grasses). Approximately 10% of the Unit is covered by chaparral. Riparian areas and agricultural lands (pasturelands/grasslands, hay/alfalfa fields, orchards, and vineyards) constitute 20% of the area. Grasslands, pastures, and oak woodlands are particularly important to both Roosevelt and tule elk in the Unit. Habitat used by Roosevelt elk within the King Range and Sinkyone Wilderness includes coastal prairies, mixed conifers, scrub oak, and chaparral

Approximately 80% of the Unit is private land used primarily for timber, livestock and agricultural crop production. Primary public land agencies include the United States Department of Agriculture Forest Service (USFS; Mendocino National Forest), the United States Department of Interior Bureau of Land Management (BLM; Arcata and Ukiah Field Offices), California Department of Parks and Recreation (CDPR), California Department of Fish and Wildlife (Department; Mattole River Ecological Reserve, Little Red Mountain Ecological Reserve, and Little Butte Ecological Reserve) and California Department of Forestry and Fire Protection (CAL FIRE - Jackson Demonstration State

Forest). Public land currently supporting Roosevelt elk includes a portion of BLM's 68,000 acre King Range National Conservation Area, and the 7,500 acre Sinkyone Wilderness State Park immediately south of the King Range National Conservation Area. Elk use of BLM Wilderness Areas (Yuki Wilderness, South Fork Eel River Wilderness, and Elkhorn Ridge Wilderness) and the USFS Mendocino National Forest has been increasing in recent years.

Recreational activities involving elk within the Unit include hunting, photography, wildlife viewing, nature study, and shed collecting. There is limited public land within the Unit that supports Roosevelt elk but access to it is good. Access to private land that supports elk within the Unit is limited. Elk are occasionally seen from public roads that traverse private land.

Elk Distribution and Abundance

Roosevelt elk (*Cervus canadensis roosevelti*) were widely distributed throughout much of Mendocino County prior to the arrival of Europeans (Harper et al. 1967, McCullough 1969). Hybridization probably occurred where range overlapped with tule elk (*C. c. nannodes)*. Harper et al. (1967) stated that *roosevelti* and *nannodes* mingled and intergraded at the southern portion of *roosevelti* range. McCullough (1969) postulated a cline of differentiation between *roosevelti* and *nannodes* that corresponded to the transition from coastal redwood forests to inland chaparral and oak-grassland habitats, but noted a paucity of specimens to determine a dividing line based on morphometric features. Regardless of where this dividing line was, elk were extirpated from Mendocino County and decimated throughout California. Harper et al. (1967) reported that the California range of *roosevelti* declined to a small area in Humboldt and Del Norte counties by 1925. N*annodes* declined to just a few animals in Kern County by 1870 (McCullough 1969).

Sinkyone\King Range Roosevelt elk. In 1982, the California Department of Fish and Wildlife (Department) captured 18 Roosevelt elk in Prairie Creek State Park and released 17 of them in the King Range National Conservation Area. McCoy (1986) monitored the movements, activities, and habitat use of those animals from June 1982-December 1983. During that period, the elk separated into small groups and dispersed southward along the coast to Ten Mile River, north of Fort Bragg. Wengert (2000) mapped the primary distribution of the Sinkyone Roosevelt elk herd and concluded that the herd consisted of at least 65 elk. Wengert (2000) also developed recommendations for future research and management of the herd.

Monitoring efforts since 2000 involved documenting anecdotal accounts and sightings. Roosevelt elk are not distributed uniformly throughout the Unit. The Unit has a population estimate of 115 elk based upon current and historical monitoring efforts. Groups have become established along the North Coast of Mendocino County in coastal prairies at the north end of the Sinkyone Wilderness State Park (Needle Rock), within the Usal Creek drainage, and south to the Ten Mile River's mouth north of Fort

Bragg. Additionally, the Department has received periodic reports of elk in Laytonville, Sherwood Valley, and Fort Bragg. Although genetic analysis has not confirmed the classification of these animals, they may be Roosevelt elk or Roosevelt-tule elk hybrids.

Tule Elk within the Mendocino Roosevelt Elk Management Unit. Between 1978 and 1988**,** the Department released more than 300 tule elk at multiple locations in or near the Mendocino Unit. Some releases occurred in eastern Mendocino County and western Lake County (refer to the Mendocino Tule Elk Management Unit document for detailed information on these releases). Tule elk are now established in Long Valley, Round Valley, Little Lake Valley, Eden Valley, and Sherwood Valley. These sites, 40-50 air miles from the King Range, are well within dispersal abilities of Roosevelt elk.

Management Goals, Objectives, and Actions

Management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 4) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is increasing and has not reached the upper population identified in Objective 1.6, however systematic population and habitat monitoring data has not been collected across the Unit. Collecting data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Population management for the Unit involves efforts to increase elk numbers where suitable on public lands, while working to reduce or stabilize elk numbers in conflict areas. A conservative level of regulated elk hunting promotes natural range expansion and growth towards the upper population objective in areas without conflict. Targeted elk hunting provides depredation relief in areas where reoccurring conflict with agriculture and humans exists. The Mendocino Unit is large and contains several tule elk groups and an unknown number of Roosevelt elk groups. One potential harvest strategy is to divide the hunt zone into smaller units and set tag quotas for these smaller areas and groups. This would allow the Department to tailor harvest levels to group population levels, provide greater flexibility in tag numbers and harvest rates, and more effectively manage localized elk population levels.

Elk heavily utilize private lands, which in some areas causes conflict with landowners. Expanding elk use of private lands where they are tolerated is one method to successfully increase their population. Private lands where the presence of elk may be tolerated or encouraged include timberlands, ownerships enrolled in the Private Lands Management (PLM) program, and other properties where elk are desired by the landowner. Where suitable, unoccupied elk habitat exists, management actions should facilitate natural dispersal or through translocations to reestablish elk where conflicts will be minimal. The Department should collaborate with BLM in improving habitat conditions on public land (see the Resource Management Plan and Final Environmental Impact Statement for the King Range National Conservation Area under Unit Highlights).

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promotes a mix of habitat types and successional stages including forest openings and meadows that benefit elk. To achieve these objectives, the Department will collaborate with state and federal agencies, Tribes, and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.2
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2023.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Action 1.2.3
Coordinate with public land agencies, Tribes, and non-governmental organizations and establish a timeline to evaluate the potential for elk translocations. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, CAL FIRE, CDPR, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Participate in landscape-level planning efforts, to the extent possible, to identify potential impacts and make recommendations to benefit elk and elk habitat. Ongoing.

Action 1.3.5
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease), by 2025.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2023.

Objective 1.5. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 200-1,000 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However,

there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes.

Identified issues include; the need to assess the number and composition of elk populations utilizing tribal lands; the need for habitat restoration; the significance of potential limiting factors affecting elk management; the potential for translocation of elk onto tribal land; and regulation of hunting, among others. The Department is committed to working with Tribes on enhancing elk habitat.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes to develop co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Objective 2.2. Work with Tribes to complete monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat by 2023.

Action 2.2.1
Collaborate with interested Tribes to identify monitoring and habitat projects and establish a timeline for implementation. Expected completion: 2019.

Action 2.2.2
Coordinate with interested Tribes to identify Department approved research projects utilizing GPS collars to assess habitat use. Expected completion: 2023.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt

periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. This Unit is large and contains numerous elk groups for which different management options may be considered in the future. This may include dividing the hunt zone into smaller units and setting tag quotas for the smaller areas/subherds. Another option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts and reduce hunting pressure on elk inhabiting public lands.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits. Other programs to improve public hunting access on private land have yet to be implemented within the Unit, but as additional landowners learn about the SHARE program, public access opportunities for elk hunting may increase.

Objective 3.1. Increase elk hunting opportunities by at least 10% by 2023, where feasible and compatible with population objectives.

Action 3.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 3.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Objective 3.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.2.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Private property conflicts involving Roosevelt elk within the Unit have been minimal, and the current population management strategy is intended to allow continued dispersal and reestablishment of

Roosevelt elk within suitable habitat. Both Roosevelt and tule elk occur in the Unit and cannot readily be distinguished in the field, so either subspecies may be taken by hunters. Several landowners are licensed to hunt elk through the PLM program, but most of the PLM harvest has been tule elk. Very few Roosevelt elk have been taken, but they are increasingly encountered outside the King Range/Sinkyone Wilderness.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program is currently not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. The Department can adjust annual harvests to address human-elk conflicts. Where substantial human-elk conflicts occur, the Department may implement elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve their tolerance of elk. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize use of regulated hunting and co-management with Tribes to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. The Department may issue depredation permits when readily identifiable animals cause property damage. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful.

Objective 4.1. Continue to monitor human-elk conflicts on private property.

Action 4.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 4.1.4
Develop specific elk hunting boundaries (sub-divide Unit into multiple elk zones) to better distribute harvest to assist in alleviating private property conflicts and localized increases in elk populations. Expected completion: 2020.

Action 4.1.5
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.6
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Roosevelt elk have been reestablished within the Unit for over 30 years. Population density is low and an upper limit has not been established or reached. Tule elk have been established within portions of the Unit for over 30 years. Tule elk reintroduction criteria initially emphasized maintaining genetically pure tule elk stock (primarily because of the precipitous decline in tule elk numbers), and discouraged hybridization with Roosevelt elk. However, hybridization likely occurred under historical conditions and may currently be occurring within the Unit.

The Department has not detected signs of inbreeding or reproductive suppression in the Unit's elk population, and believes that the subgroups are viable and not in danger of declining, as evidenced by their long-term presence in these areas. To monitor inbreeding, hybridization, and reproduction, the Department should gather baseline population, genetic, and recruitment information.

It is unknown whether exchange of individuals occurs with the adjacent North Coast Roosevelt Elk Management Unit. Augmenting the Mendocino Unit with additional Roosevelt elk on an opportunistic basis may contribute to genetic diversity and herd viability. Elk should be tested to identify their genetic makeup and limit the possibility of translocating hybridized elk.

Summary of Annual Harvests

The Fish and Game Commission authorized public elk hunting within the Unit in 2010, with a conservative tag quota (Table 1). It is important to note that while Roosevelt elk do occur within the public hunt zone, hunter harvest reporting indicates most of the

public harvest consisted of tule elk near established elk PLMs (Table 1). Based on this reporting, the current harvest strategy is conservative and should have negligible impacts on Roosevelt elk population numbers and distribution within the Unit. However, the Department should conduct genetic analysis to determine the subspecies of harvested animals, as well as the documentation of any hybridization between subspecies.

Unit Highlights

Cooperation and support of public agencies and private landowners was critical to the initial effort to reestablish Roosevelt elk within the Mendocino Unit. The Department has monitored elk within the Unit and collaborated with management agencies and NGOs to implement research and monitoring. Below is a partial listing of these activities:

- In 2014, BLM completed its Resource Management Plan and Final Environmental Impact Statement for the King Range National Conservation Area.
- In 2015, Sinkyone Wilderness State Park volunteers completed trail surveys to collect trend data on elk numbers and ratios (Table 2). Population parameters (total numbers, trends, age/sex ratios) are estimated (Table 3), along with factors that might limit numbers.

An opportunity exists to collaborate further with BLM, Rocky Mountain Elk Foundation, and other conservation groups to develop additional recommendations to improve habitat conditions and expand elk distribution on public land within the King Range. Universities and management agencies have monitored elk and elk habitat within the Unit. A partial listing of studies submitted to the Department includes the following:

Unit Specific Research

Bureau of Land Management. 2004. Resource management plan and final environmental impact statement for the King Range National Conservation Area. Bureau of Land Management, Sacramento, California, USA.

California Department of Parks and Recreation. 2006. Sinkyone wilderness state park final general plan and environmental impact report SCH# 2003022115. California Department of Parks and Recreation, Sacramento, USA.

Wengert, G.M. and Kitchen, D.W. 2008. Gender related differences in nursing behavior by Roosevelt elk. Northwestern Naturalist 89:10-16.

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California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

Harper, J.A., J.H. Harn, W.W. Bentley, and C.F. Yocum. 1967. The status and ecology of the Roosevelt elk in California. Wildlife Monographs 16:3-49.

McCoy, M. 1986. Movements, habitat use and activity patterns of a transplanted group of Roosevelt elk. Thesis, Humboldt State University, Arcata, California, USA.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Wengert, G.M. 2000. Report to California Department of Parks and Recreation. Demography, range, habitat, condition and parasites of the Roosevelt elk (*Cervus elaphus roosevelti*) of Sinkyone Wilderness State Park, Mendocino County, California. California Department of Parks and Recreation, Sacramento, USA.

Data Tables/Figures

Table 1. Elk Harvest within the Mendocino Roosevelt Elk Management Unit.

Take of Roosevelt elk or tule elk is allowed. Private Lands Management Area harvests reported from 1989-2012 consisted primarily of tule elk; Public harvests from 2010-2016 consisted of both tule and Roosevelt elk.

Year	Public Bull Tags		Public Antlerless Tags		SHARE Bull Tags		SHARE Antlerless Tags		Reported PLM Harvest		
	Issued	Harvest	Issued	Harvest	Issued	Harvest	Issued	Harvest	Bulls	Antlerless	Number of Ranches
2008									11	9	6
2009									13	9	6
2010	2	2	2	0					16	24	6
2011	2	2	2	1					18	19	5
2012	2	2	2	1					18	15	6
2013	2	1	2	1					15	16	7
2014	2	2	2	1					13	17	7
2015	2	2	2	1	2	2	4	4	20	18	9
2016	2	2			2	2	4	4	18	18	9
Totals	**14**	**13**	**12**	**5**	**2**	**2**	**4**	**4**	**142**	**145**	**61**
Success Rate	**93%**		**42%**		**100%**		**100%**				

Table 2. Sinkyone Wilderness State Park Elk Census Results, 2000-2015.

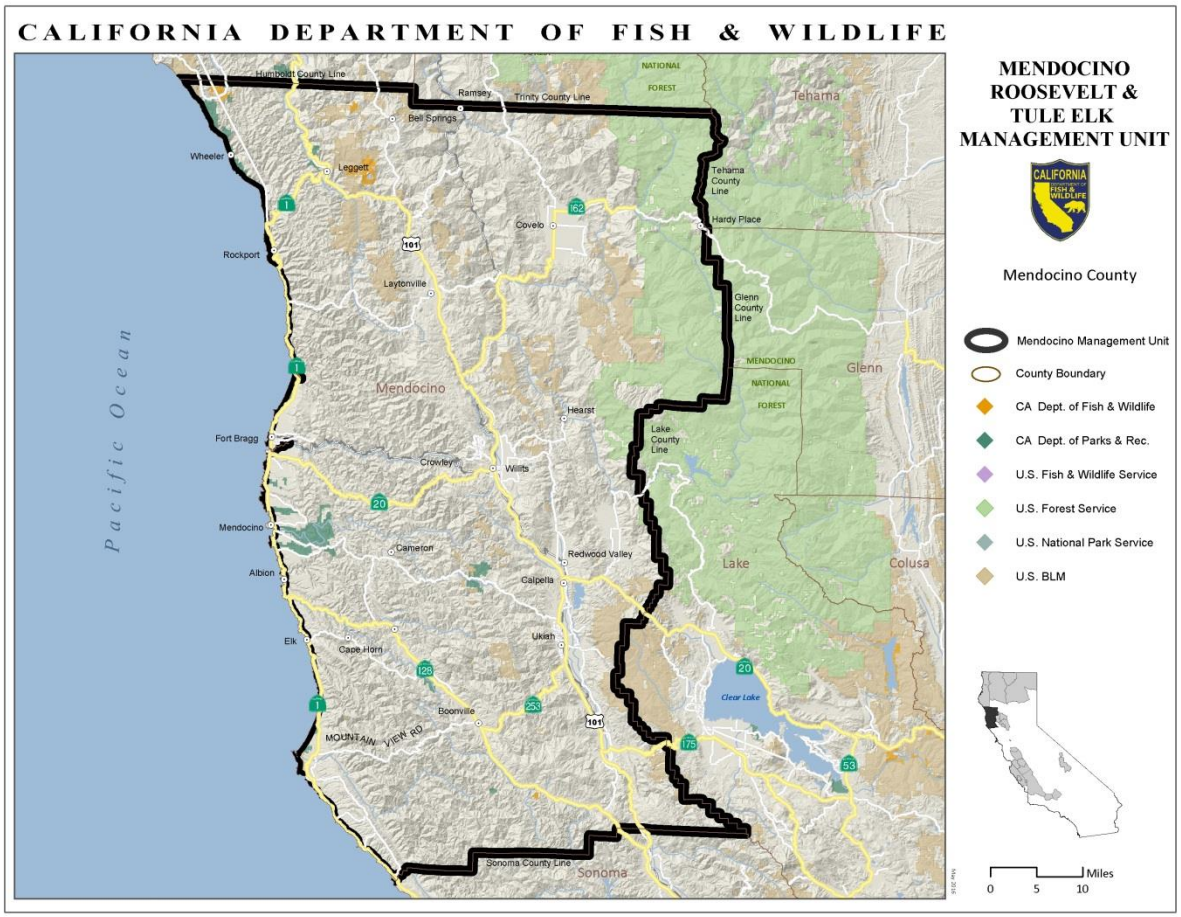
Year	Bulls	Cows	Calves	Total	Source
2000	12	43	8	**63**	2000 SWSP elk report by Dr. Greta Wengert
2014	11	32	5	**48**	2014 SWSP Elk Census by Dr. Ellie Bush
2015	10	33	10	**53**	2015 SWSP Elk Census by Dr. Ellie Bush

No surveys were conducted between 2000-2014.

Table 3. Roosevelt Elk Population Estimates within the Mendocino Unit.

Location	Estimate	Notes
Mendocino National Forest	**10**	May be Roosevelt or Tule
Ten Mile	**5**	Reports of elk sightings, most likely Roosevelt
Trinity-Humboldt-Mendocino along Eel River	**30+**	Reported sightings
Usal - Sinkyone Area through Westport	**70**	

Mendocino Tule Elk Management Unit



Mendocino
Tule Elk Management Unit

Description

The Mendocino Tule Elk Management Unit (Unit) occurs entirely within Mendocino County. Specific boundaries are: within a line beginning at the Pacific Coastline and the Mendocino/Humboldt County line south of Shelter Cove; east along the Mendocino/Humboldt County line to the intersection of the Humboldt, Mendocino, and Trinity County lines; south and east along the Mendocino/Trinity County line to the intersection of the Mendocino, Trinity, and Tehama County lines; south along the Mendocino County line to the intersection Mendocino and Sonoma County lines: west along the Mendocino County line to the Pacific Coastline; north along the Pacific Coastline to the point of beginning.

The Unit is within the North Coast and Klamath Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). It is a system of north and northwest-trending mountains and valleys. Elevation extends from sea level to 6,954 feet at Anthony Peak. Summer temperatures can exceed 95° (F) at inland locations, and in winter freezing temperatures occur in many areas. Annual precipitation varies from 45 to 80 inches.

Vegetation is dominated by redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), and mixed coniferous forests. Forests cover over 50% of the county. Woodlands and savannahs comprise 15% of the county and include species such as California black oak *(Quercus kelloggii)*, Oregon oak *(Quercus garryana)*, alder *(Alnus spp.)*, dogwood *(Cornus spp.)*, Oregon ash *(Fraxinus latifolia)*, bigleaf maple *(Acer macrophyllum)*, buckeye *(Aesculus spp.)*, poison oak *(Toxicodendron diversilobum)*, manzanita *(Arctostaphylos spp.)*, *Ceanothus*, chamise *(Adenostoma)*, currant *(Ribes spp.)*, blackberry *(Rubus spp.)*, and annual grasses. Approximately 10% of county lands are covered by chaparral. Riparian areas and agricultural lands (pasturelands/grasslands, hay/alfalfa fields, orchards, and vineyards) constitute 20% of the area. Grasslands, pastures, and oak woodlands are particularly important to both Roosevelt (*Cervus canadensis roosevelti*) and tule elk (*Cervus canadensis nannodes*) in the Unit.

Approximately 80% of the Unit is private land used primarily for timber, livestock and agricultural crop production. Primary public land agencies include the United States Department of Agriculture Forest Service (USFS; Mendocino National Forest), the United States Department of Interior Bureau of Land Management (BLM: Arcata and Ukiah Field Offices), California Department of Parks and Recreation (CDPR), California Department of Fish and Wildlife (Department; Mattole River Ecological Reserve, Little Red Mountain Ecological Reserve, and Little Butte Ecological Reserve) and California Department of Forestry and Fire Protection (CAL FIRE; Jackson Demonstration State Forest).

Elk can be seen by the public from Highway 101 near Laytonville, along Reynolds Highway near Willits, from Short Creek Road in Round Valley, on the eastern edge of Lake Mendocino, and occasionally from Highway 20 near Potter Valley. Public access to other areas utilized by elk is generally restricted to private landowners and their guests. Strategies to improve access are limited. Recreational activities involving elk within the Unit include hunting, photography, wildlife viewing, nature study, and shed collecting.

Elk Distribution and Abundance

The Department has released over 300 elk at multiple locations in or near the Mendocino Unit since 1978. Major tule elk translocations prior to 1990 occurred as follows:

- 156 elk were relocated to the Lake Pillsbury unit (in Lake County immediately east of the Mendocino Unit) from 1978-1985.
- 45 elk (from Owens Valley, San Luis Refuge and Mt. Hamilton) were relocated to Long Valley (Laytonville) within the Mendocino Unit from 1979-1982.
- 59 elk from San Luis Refuge were released in the Mendocino National Forest (southeast of Lake Pillsbury near Bartlett Springs in Lake County) in 1985.
- 30 elk (from Grizzly Island and Tupman Tule Elk State Reserve) were released on the west side of Eden Valley within the Mendocino Unit during 1986.
- 40 elk from Grizzly Island were released at Elk Creek within the Mendocino Unit in 1988 (Elk Creek is less than 5 miles from Eden Valley).

Some elk from these releases were fitted with radio telemetry (VHF) transmitters and subsequently monitored. Some translocated elk dispersed into the Unit. At least 15 elk released near Lake Pillsbury moved about 14 miles southwest and became established at Potter Valley within the Mendocino Unit by the end of 1981.

Although most releases occurred on or near public land (e.g. Elk Creek and Lake Pillsbury), tule elk subherds became established primarily on private property. The 1988 management plan for the Mendocino Unit reported that private property comprised more than 90% of the area inhabited by elk. Tule elk apparently prefer private grasslands, pasturelands and alfalfa/hay fields associated with livestock grazing/production.

The Unit currently supports seven subherds, named for the area inhabited by the cow\calf groups as follows: Round Valley (or Covelo), Eden Valley, Long Valley (Laytonville), Sherwood Valley, Little Lake Valley, Northern Mayacamas, and Potter Valley. Each subherd is described briefly below.

Round Valley Subherd. This subherd inhabits the String Creek and Eel River watersheds. Land ownership is private and includes the Round Valley Indian Reservation. Typical vegetation includes coastal oak woodlands and chaparral.

Pasturelands, valley floor grasslands, alfalfa/hay fields and oak woodlands are important to tule elk. Cattle ranching and tribal activities are primary land uses. With establishment of the Mendocino Elk Zone and landowner approval, limited public take of elk from this subherd could occur.

The Department has monitored the Round Valley subherd intermittently over the last 15 years. This subherd currently is hunted under two PLMs. The Department estimates there are over 70 elk in the Round Valley subherd (Table 1).

Eden Valley Subherd. This subherd inhabits the Elk Creek and Eel River watersheds. Land ownership is predominantly private cattle ranches; public land is multiple-use and/or recreational, managed by BLM and Mendocino National Forest (Yuki Wilderness). Specific habitats important to tule elk include grasslands, chaparral and oak woodlands containing valley (*Q. lobata*) and black (*Q. kelloggii*) oaks. This subherd has increased steadily over the last 20 years and contains approximately 190 elk (Table 2).

Long Valley (Laytonville) Subherd. This subherd inhabits the Long Valley Creek and Eel River watersheds. Land ownership is predominantly private, with cattle ranching, hay production, and timber activities. Specific habitats important to tule elk include pasturelands, valley floor grasslands, hay fields, chaparral, valley and black oak woodlands and montane hardwood-conifer stands. Elk from the Long Valley subherd are hunted through the PLM program. With establishment of the Mendocino Public Elk Hunt and landowner approval, limited public take of elk from this subherd can occur.

Table 3 summarizes observed population numbers for the Long Valley subherd from 2000-2016. Population numbers appear to have increased over time, and the number of elk counted and classified has increased steadily since 2006. The Long Valley subherd currently contains approximately 220 elk.

Sherwood Valley Subherd. The Sherwood Valley subherd may have established through natural dispersal from Long Valley in the 1980s. This subherd inhabits the Sherwood Creek and Eel River watersheds. Land ownership is private, including the Sherwood Valley Rancheria, and is primarily used for cattle ranching. Important tule elk habitats include pasturelands, annual grasslands, mixed chaparral, higher elevation valleys, montane hardwood\conifer and redwood\conifer forests. With establishment of the Mendocino Public Elk Hunt and landowner approval, limited public take of elk from this subherd also can occur.

Observed numbers for the Sherwood Valley subherd have increased over time, although annual reports of population numbers are limited. In 2008, the Management Plan for the Spring Valley Ranch stated that the Sherwood Valley subherd contained 60-70 elk. This subherd currently contains over 200 elk, which is more than double in size since 2008.

Little Lake Valley Subherd. The Little Lake Valley subherd may have been established through natural dispersal from Sherwood Valley around 2010. This subherd inhabits the Outlet Creek and Eel River watersheds. Private lands are used primarily for cattle ranching. On public lands, the elk move between the City of Willits treatment plant property, and mitigation lands managed by the Mendocino Resource Conservation District for the Department. Important tule elk habitats include pasturelands, annual grasslands, valley floor grasslands, hay fields, and oak and Oregon ash woodlands. This subherd is relatively new, and hunting should be delayed until its numbers improve.

Observed numbers for this subherd have increased over the last five years, and currently contains approximately 25 elk, more than triple its size in 2012 (Table 4).

Potter Valley Subherd. This subherd inhabits the Cold Creek, Mewhinney Creek, and Russian River watersheds. Specific habitats important to tule elk include pasturelands, valley floor and upland grasslands, alfalfa/hay fields, and oak woodlands. Land ownership is private and used for cattle ranching and, to a lesser extent, recreation. With establishment of the Mendocino Public Elk Hunt and landowner approval, limited public take of elk from this subherd can occur apart from the PLM program.

Table 5 displays observed population numbers for the Potter Valley subherd from 1981-2016. While observed numbers have fluctuated from one year to the next, the subherd numbers have increased overall since 1981 (Table 5). The Potter Valley subherd currently contains at least 270 elk and is above the desired objectives.

Northern Mayacamas subherd. The Northern Mayacamas subherd inhabits the Russian River watershed. The northern Mayacamas Mountains are located south of the Mendocino Range, west of Clear Lake, and east of Ukiah, in Mendocino County. Specific habitats important to tule elk include upland grasslands, chaparral, oak woodlands, and upper annual grassland slopes. The area is a mix of private and public lands. The BLM and Army Corps of Engineers manage the public lands. This subherd currently contains approximately 45 elk, more than triple its size in 2005.

These elk have been expanding south along the range towards the UC Hopland Research and Extension property. Additionally, over the past 35 years, occasional sightings have been reported elsewhere within the Unit at places such as Reeves Canyon, Redwood Valley, Ukiah, and most recently Ten Mile (Fort Bragg), Mina, Poonkiney Ridge, and Piercy. These small groups may collectively total 60-70 animals. The extent to which they might intermingle with established subherds is unknown.

The Department has conducted ground surveys throughout portions of the Unit over time, augmented periodically with helicopter surveys. In 2016, helicopter surveys were resumed after a six-year suspension with counts on the Potter Valley subherd. From this data along with data collected from ground surveys from properties enrolled in the Private Lands Management (PLM) program, the Department estimates that the Unit currently contains approximately 1,100 tule elk (Table 6).

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing; and 4) alleviate human-elk conflicts. Specific objectives and actions recommended to achieve each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population in this Unit is increasing, and has not yet reached the upper population identified in Objective 1.6. Collecting elk population and habitat data will allow the Department to track trends through time, and measure the success of enhancing elk populations and their habitat.

Population management for this Unit involves efforts to increase elk numbers where suitable on public lands, while working to reduce or stabilize elk numbers in conflict areas. A conservative level of regulated elk hunting promotes natural range expansion and population growth towards the upper population objective in areas without conflict, and targeted elk hunting and depredation relief in areas where reoccurring conflict with agriculture and humans exists. The Unit is large and currently contains several tule elk subherds and an unknown number of Roosevelt elk subherds. A potential harvest strategy is to divide the hunt zone into smaller units and set tag quotas for these smaller areas/subherds. This would allow the Department to tailor harvest levels to subherds, provide greater flexibility in tag numbers and harvest rates, and more effectively manage localized elk population levels.

Currently, elk in the Unit appear to utilize private lands disproportionately greater than their availability, which in some areas causes conflict with landowners. Expanding elk use of private lands where elk are tolerated is another method to successfully increase elk populations. Private lands where the presence of elk may be tolerated or encouraged include timberlands, ownerships enrolled in the PLM program, and other properties where elk are desired by the landowner. Where suitable unoccupied elk habitat exists, management actions should facilitate natural dispersal or translocations to reestablish elk where conflicts will be minimal.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages including forest openings and meadows that benefit elk. To

achieve these objectives, the Department will collaborate with state and federal agencies, Tribes, and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.2
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Continue population monitoring with helicopter surveys and augmented, as necessary, with ground surveys conducted in cooperation with local landowners. Ongoing.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2023.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Action 1.2.3
Coordinate with public land agencies, Tribes, and non-governmental organizations and establish a timeline to evaluate the potential for elk translocations. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, CAL FIRE, CDPR, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.5
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2025.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2023.

Objective 1.5. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 800-2,500 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes.

Identified issues include; the need to assess the number and composition of elk populations utilizing tribal lands; the need for habitat restoration; the significance of potential limiting factors affecting elk management; the potential for translocation of elk onto tribal land; and regulation of hunting, among others. The Department is committed to working with Tribes on enhancing elk habitat.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes to develop co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Objective 2.2. Work with Tribes to complete monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat by 2023.

Action 2.2.1
Collaborate with interested Tribes to identify monitoring and habitat projects and establish a timeline for implementation. Expected completion: 2019.

Action 2.2.2
Coordinate with interested Tribes to identify Department approved research projects utilizing GPS collars to assess habitat use. Expected completion: 2023.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. This Unit is large and contains numerous elk groups for which different management options may be considered in the future. This may include dividing the hunt zone into smaller units and setting tag quotas for the smaller areas/subherds. Another option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts and reduce hunting pressure on elk inhabiting public lands.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Other projects to improve public hunting access on private land have yet to be implemented within the Unit, but as additional landowners learn about the SHARE program, public access opportunities for elk hunting may increase.

Objective 3.1. Increase elk hunting opportunities by at least 10% by 2023, where feasible and compatible with population objectives.

Action 3.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 3.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Objective 3.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.2.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Management actions are needed in some areas of the Unit where private property conflicts occur and elk populations are increasing.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program currently is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. The Department may recommend adjustments to annual harvests to address human-elk conflicts. Where substantial human-elk conflicts occur, the Department may implement elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve tolerance of elk on their properties. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting and co-management with Tribes to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help

alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

Objective 4.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 4.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts, and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 4.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Tule elk have reoccupied portions of the Unit since 1978. Hybridization may have occurred (or might now be occurring) with Roosevelt elk from northern Mendocino County. The historical level of range overlap and hybridization between Roosevelt and tule elk is unknown and the Department should investigate this question.

Poaching and unregulated hunting are potentially adverse impacts to the viability of the Round Valley subherd. The population appears to be slowly increasing and its size does support developing a harvest strategy exclusive for this subherd.

In contrast, the Eden Valley, Long Valley, Potter Valley, and Sherwood Valley subherds are viable and growing. Each of these subherds could increase numerically and/or disperse into suitable unoccupied habitat, especially with appropriate habitat improvement projects. Thus, as a whole, the Mendocino Unit supports viable and healthy tule elk subherds; however, further monitoring and management activity should be implemented for the Round Valley subherd.

Tule elk from the Mendocino Unit may occasionally breed with tule elk from the Lake Pillsbury and East Park Reservoir management units as well as with Roosevelt elk from southern Humboldt and northern Mendocino counties. Based on reports of PLM participants, tule elk bulls may move between subherds during the breeding season (e.g., between Round Valley and Eden Valley; Eden Valley and Long Valley; Long Valley and Sherwood Valley; Eden Valley and Lake Pillsbury). Natural interchange between subherds and/or management units could promote genetic diversity. Confirming these and other potential movement/exchange corridors would assist in the long-term management of tule elk within the Unit. The Department will monitor for hybridization between tule and Roosevelt elk.

Non-hunting mortalities from disease, predation, poaching/unregulated take, and roadways have been documented within the Mendocino Unit. The Department has not quantified these mortality factors, and the extent to which they have affected elk population growth for the Unit is unknown.

Summary of Annual Harvests

The Fish and Game Commission first authorized annual hunting under the PLM program within the Mendocino Unit in 1989. Since then, nine ranches have hunted tule elk under the PLM program (harvests listed in Table 7); mean reported PLM harvest is 15 bulls and 16 antlerless elk per year. Both the reported PLM harvest and the number of PLM participants have increased steadily since 1989 (Table 7).

In 2010, the Fish and Game Commission authorized public elk hunting with two bull and two antlerless tags per year for the Mendocino Unit. These tags are not subspecies-specific and can be used to take either tule or Roosevelt elk. Public tule elk hunting opportunities are extremely limited within the Unit and will likely continue to be so because public land that supports elk is extremely limited. Most of the harvest occurs on PLM properties (Table 7).

In 2015, tule elk hunting through the PLM program occurred on approximately 104,000 acres within the Unit, and involved the Eden Valley, Long Valley, Sherwood Valley, Round Valley and Potter Valley subherds. The current PLM harvest strategy involves determining a maximum sustained yield (MSY) for the Unit, based on population counts performed under individual PLM management plans. Recommended annual harvests that are cumulatively at or below the MSY threshold are developed in consultation with each PLM licensee; final quotas are determined by the Fish and Game Commission.

Public and PLM tags are designated as either antlerless or bull tags to allow the harvest to be stratified by sex. If it becomes necessary to control or reduce the size of a particular subherd, the Department may recommend a more liberal harvest to achieve a higher take of antlerless elk.

Based on analysis of cementum annuli, the mean age of bulls taken by hunting within the Unit since 1993 ranged from 3.4-8.3 years old, whereas antlerless elk ranged from 1.0-12.5 years old (Figure 1). Tooth samples were not collected each year for age analysis and annual sample sizes are relatively small.

Hunting has had a minimal impact on the elk population in the Unit. The average annual harvest (Table 7) is less than five percent of the estimated population of 1,000 tule elk (Table 6).

The Department has been monitoring herd numbers and meeting with PLM operators to discuss harvest rates. As elk numbers continue to increase, elk have been moving outside of existing PLM properties to areas where landowners are experiencing conflicts.

Unit Highlights

Cooperation and support from private landowners is critical to the management of tule elk within the Mendocino Unit. The Department has monitored elk within the Unit and worked collaboratively with private landowners and management agencies to reduce conflicts and improve habitat conditions. Below is a partial listing of these activities:

- In 1988, the Department prepared the Mendocino Tule Elk Management Unit Management Plan, which served to guide management efforts and assist in reducing conflicts on private property within the Unit.

- In 1989, the Department began working with private landowners licensed to participate in the PLM program and hunt tule elk (each licensee must prepare a management plan and implement projects to improve habitat conditions for wildlife).

Unit Specific Research

California Department of Fish and Game. 1988. Mendocino tule elk management unit management plan. California Department of Fish and Game, Sacramento, USA.

Fluek, W.T. and J.M. Smith-Fluek. The success of relocating tule elk (*Cervus elaphus nannodes*) to Elk Creek, Mendocino County, California. California Department of Fish and Game, Sacramento, USA.

Fowler, G.S. 1985. Tule elk in California – history, current status, and management recommendations. Interagency Agreement. #C-698. California Department of Fish and Game, Sacramento, USA.

Literature Cited

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

Data Tables/Figures

Table 1. Population Summary for the Round Valley Subherd, Mendocino Tule Elk Management Unit. Reported population size and numbers of elk counted/classified are based on Annual Renewal Report and Five Year Management Plan for the Amann Ranch (currently licensed in the Private Lands Management program).

	Number of Elk Counted/Classified			
Date	**Bulls**	**Cows**	**Calves**	**Total**
2012	12	21	11	**43**
2013	15	20	10	**45**
2014	18	20	12	**50**
2015	23	27	9	**59**
2016	23	27	9	**59**

Table 2. Population Summary for the Eden Valley Subherd, Mendocino Tule Elk Management Unit. Numbers of elk counted/classified are based on Annual Renewal Reports and Five Year Management Plans for the Eden Valley Ranch (currently licensed in the Private Lands Management program).

Number of Elk Counted/Classified					
Year	**Bulls**	**Cows**	**Calves**	**Total**	**Notes**
1992	22			**64**	Counted 42 Cows & Calves
1993	13	44	18	**75**	
1994	14	41	9	**64**	
1995	13	26	9	**48**	
1996	6	17	7	**30**	
2000	11	32	5	**48**	
2002	23	44	18	**85**	
2003	24	47	23	**94**	
2004	24	52	22	**98**	
2005	32	80-85	15-16	**127-133**	
2006	33	66	18	**117**	
2007	36	78	17	**131**	
2008	38	81	18	**137**	
2012	45	69	24	**138**	
2016	59	73	24	**156**	

Table 3. Population Summary for the Long Valley Subherd, Mendocino Tule Elk Management Unit. Reported population size and numbers of elk counted/classified are based on Annual Renewal Reports and Five Year Management Plans for the Shamrock Ranch (currently licensed in the Private Lands Management program).

	Number of Elk Counted/Classified				Reported Population Size
Date	**Bulls**	**Cows**	**Calves**	**Total**	
2000					61-120
2002					125-130
2003					125-135
2004					135-150
2006	16	56	15	**87**	
2007	24	53	16	**93**	
2008	37	60	23	**120**	
2009	41	68	28	**137**	
2010	47	76	26	**149**	
2012	51	86	25	**162**	
2016	51	85	43	**179**	100-300

Table 4. Population Summary for the Little Lake Valley Subherd, Mendocino Tule Elk Management Unit. Reported population size and numbers of elk counted/classified are based on visual counts.

Number of Elk Counted/Classified				
Date	**Bulls**	**Cows**	**Calves**	**Total**
2012	2	3	1	**6**
2013	2	4	1	**7**
2014	3	5	4	**12**
2015	5	9	5	**19**
2016	5	9	4	**18**

Table 5. Population Summary for the Potter Valley Subherd, Mendocino Tule Elk Management Unit. Reported population size and numbers of elk counted/classified prior to 1988 are based on the 1988 Mendocino Tule Elk Management Unit Management Plan (prepared by CDFW); Parameters from 1988 - 2012 are based on Annual Renewal Reports and Five Year Management Plans for the Potter Valley Ranch (currently licensed in the Private Lands Management program).

Date	Number of Elk Counted/Classified				Reported Population Size	Notes
	Bulls	Cows	Calves	Total		
1981					15-25	
1982					25-35	
1983					35-50	
1984					60-70	
1985	13-Oct	40-44	13-Oct		60-70	11 Cows Relocated from Potter Valley
1986	13-23	31-42	26-35		75-100	
1987	35-37	56-64	20-24		110-125	
1988					100-110	
1990					120-130	
1991					130-150	
1993	18-Nov	28-30	20-22		60-70	
1994	21-27	28-37	16-Dec		61-80	
1995	14-Dec	36-75	11-Jul		55-100	
1996	19+	27+	10+		68-72	
1997	28+	35+	19+		82-95	
1998					95+	
1999	25+	47+	23+		95-115	
2002	30-34	31-35	26-29		87-120	
2003	32-34	40-58	26-31		98-123	
2004	27-34	35-44	29-40		91-118	
2005	16-20	35-40	24-35		75-95	
2006	21-29	41-50	27-31		89-100	
2007	20-26	45-55	25-29		90-110	
2008	15-20	55-75	40-55		110-150	
2009	29-32	91-101	57-77		177-210	
2010	32	115	65	**212**		
2012	50	69	46	**165**		
2016	50	155	48	**253**		

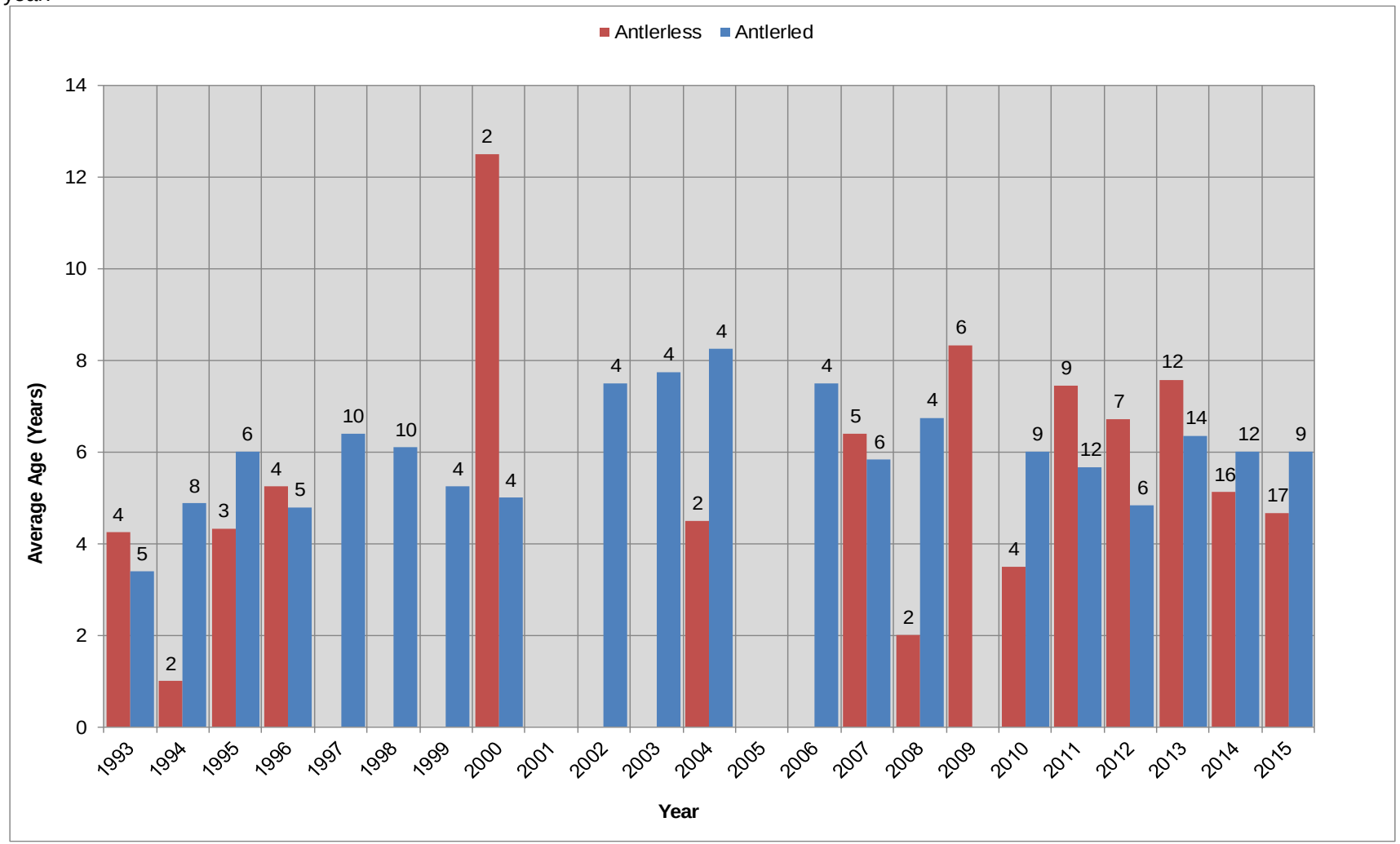
Table 6. Tule Elk Population Estimate within the Mendocino Unit

Location	Bulls	Cows	Calves	Total	Estimate	Notes
Brushy Mountain (Summer Camp Ranch)	15	0	0	**15**	**15**	Mostly a bull group use area and migratory corridor - no cow groups observed yet
Covelo Valley/Round Valley	23	27	9	**59**	**70**	Based on field and PLM counts
Eden Valley	59	73	24	**156**	**190**	Based on field and PLM counts
Lake Mendocino	4	8	3	**15**	**15**	Based on photo
Little Lake Valley	5	9	4	**18**	**25**	Based on field counts
Laytonville-Long Valley	51	85	43	**179**	**220**	Based on field and PLM counts
Mendocino National Forest					**10**	May be Roosevelt or Tule
Northern Mayacamas					**45**	
Potter Valley	50	155	48	**253**	**270**	Based on aerial counts
Sherwood Valley (Spring Valley Ranch)	56	100	61	**217**	**220**	Based on field and PLM counts
Strong Mountain - Clark Ranch					**50**	Reports of elk in area
Other areas					**60**	Reports of elk in area

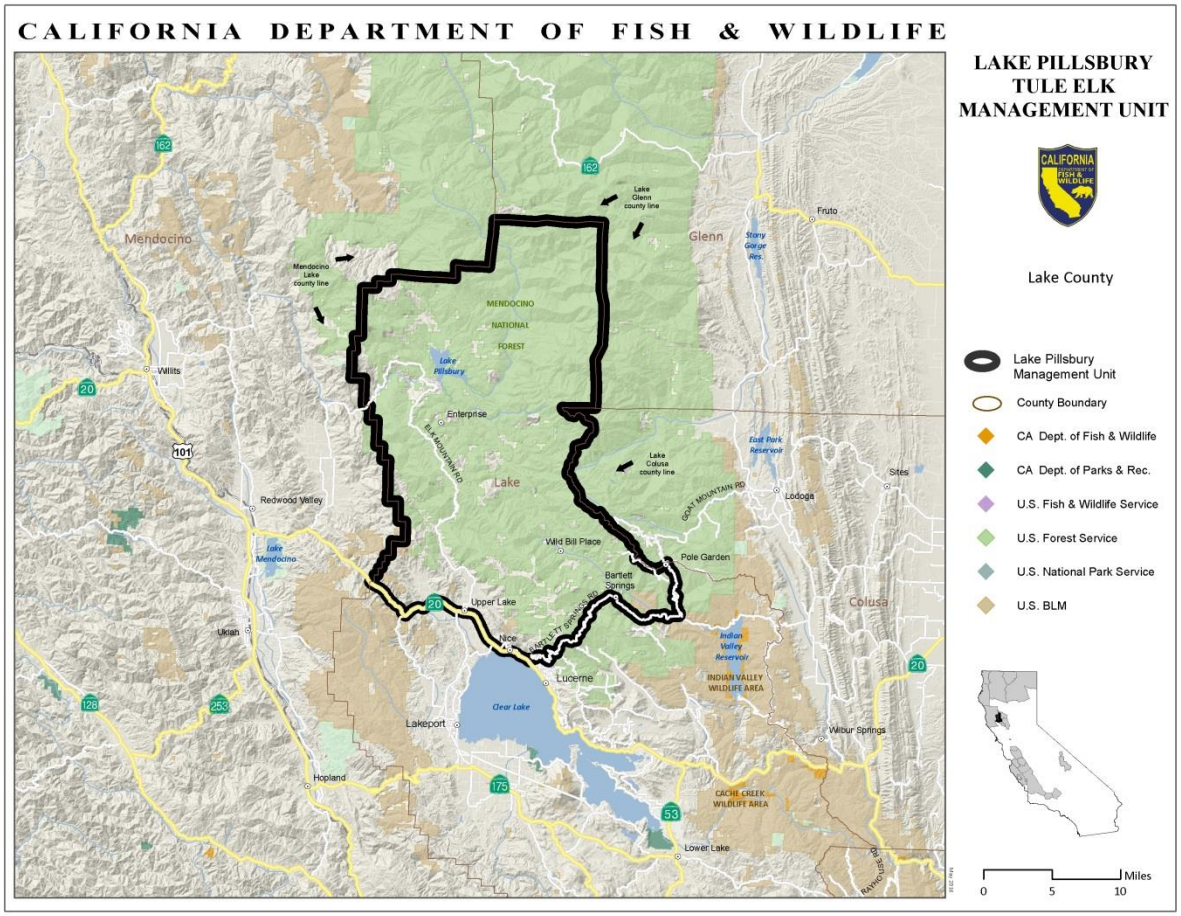
Table 7. Mendocino Tule Elk Management Unit, Reported Private Lands Management Area Harvests, 1989-2016, and Public Quotas and Harvests, 2010-2016. Take of Roosevelt or tule elk is allowed within the public hunt zone.

Year	Public Bull Tags		Public Antlerless Tags		SHARE Bull Tags		SHARE Antlerless Tags		Reported PLM Harvest		
	Issued	Harvest	Issued	Harvest	Issued	Harvest	Issued	Harvest	Bulls	Antlerless	Number of Ranches
1989									3	5	1
1990									4	0	1
1991									3	3	1
1992									6	9	3
1993									6	5	3
1994									9	3	3
1995									6	3	2
1996									5	4	3
1997									10	2	4
1998									10	0	4
1999									14	5	5
2000									8	7	5
2001									4	6	5
2002									6	4	4
2003									16	10	5
2004									12	6	5
2005									13	9	6
2006									8	10	6
2007									13	8	6
2008									11	9	6
2009									13	9	6
2010	2	2	2	0					16	24	6
2011	2	2	2	1					18	19	5
2012	2	2	2	1					18	15	6
2013	2	1	2	1					15	16	7
2014	2	2	2	1					13	17	7
2015	2	2	2	1	2	2	4	4	20	18	9
2016	2	2			2	2	4	4	18	18	9
Totals	14	13	12	5	2	2	4	4	298	244	
Success Rate	93%		42%		100%		100%				

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting (Private Lands Management Areas and General) within the Mendocino Tule Elk Management Unit, 1993 - 2015. Sample sizes are denoted above bars for each year.



Lake Pillsbury Tule Elk Management Unit



Lake Pillsbury
Tule Elk Management Unit

Description

The Lake Pillsbury Tule Elk Management Unit (Unit) in Lake County includes land near Lake Pillsbury. Boundaries are described as follows: that portion of Lake County within a line beginning at the junction of the Glenn-Lake County line and the Mendocino County line; south and west along the Mendocino-Lake County line to Highway 20; southeast on Highway 20 to the intersection of Bartlett Springs Road; north and east along Bartlett Springs Road to the intersection of Forest Route M5; northwest on Forest Route M5 to the Colusa-Lake County Line; northwest and east on the Colusa-Lake County Line to the junction of the Glenn-Colusa County Line and the Lake-Glenn County Line; north and west on the Lake-Glenn County Line to the point of beginning. The Lake Pillsbury Unit spans approximately 300,000 acres and is within historical tule elk (*Cervus canadensis nannodes*) range as depicted by McCullough (1969).

The Unit is within the North Coast and Klamath Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). Climate is Mediterranean with hot, dry summers and cool, moist winters. Temperature extremes can exceed 100° F in summer and fall well below 32° F in winter. Topography is generally flat in the basin around Lake Pillsbury. Surrounding areas are characterized by steep ridges and narrow valleys. Elevations range from 1,800 feet at Gravelly Valley to almost 6,900 feet at Hull Mountain. Lake Pillsbury, the Eel River, Salmon-Fuller, Smokehouse, Squaw Valley and Mendenhall creeks are prominent water sources within the Unit.

Major vegetation types found in the Unit include mixed conifer-hardwood conifer forests, and mixed chaparral habitats. Drier gravel soils support hardwoods, gray pine (*Pinus sabiniana*), manzanita (*Arctostaphylos manzanita*), and ceanothus spp. Grasslands, meadows (resulting from draw down from Lake Pillsbury), and willow/riparian habitats important to tule elk are also found within the Unit.

More than 75% of the Unit consists of public land, administered by the United States Department of Agriculture Forest Service (USFS; Mendocino National Forest) and the United States Department of Interior Bureau of Land Management (BLM; Ukiah Field Office). Lake Pillsbury is formed by Scott Dam near the headwaters of the Eel River. Most of the inundated land and approximately 700 acres adjacent to the lake is owned by Pacific Gas and Electric Company (PG&E), for operation of the Pillsbury hydroelectric project. Other private land within the Unit is used for agricultural purposes (primarily livestock and timber production). A private subdivision provides primary and vacation residences near Lake Pillsbury and the Mendocino National Forest. Access to the Unit is good and recreational activities that involve elk include hunting, photography, viewing, nature study and shed collecting.

Elk Distribution and Abundance

From 1978-1985, the California Department of Fish and Wildlife (Department) released 156 tule elk from the Owens Valley to Booth Crossing and Bartlett Springs/Potato Hill near Lake Pillsbury. Most of these elk left the area. Several animals traveled west approximately 14 miles, and became established at Potter Valley, while others traveled east and became established at East Park and Stonyford. A number of animals did not survive, and by 1995 the Lake Pillsbury herd contained only 15-20 animals. In 1999, 11 elk (1 adult female, 2 male calves, 8 female calves) from Concord Naval Weapons Station were released near Lake Pillsbury; most of these animals remained near the release site. Today elk are generally found in the Lake Pillsbury Basin of the Mendocino National Forest; however, the Department has also documented use in the Mendenhall Creek and Dashiell Creek drainages of Mendocino County. Use of the Bartlett Springs/Potato Hill area has been minimal.

Population numbers have increased since 1995 (Table 1), and the Lake Pillsbury Unit currently contains approximately 125 elk, based on surveys. Some elk from the Concord translocation were equipped with radio telemetry (VHF) transmitters and monitored after their release. More recently, individual animals were equipped with both GPS and VHF transmitters for intensive monitoring of distribution, movements, and habitat use. GPS locations indicate extensive use of the north end of Lake Pillsbury and surrounding forested areas by elk.

In August 2013, the National Veterinary Services Laboratories in Ames, Iowa identified chewing lice (*Damalinia* [= *Cervicola*] *sp*. Keler; hereafter, referred to as exotic lice) collected from one elk within the Lake Pillsbury Unit. Exotic lice have been associated with hair loss syndrome (alopecia) in black-tailed deer (*Odocoileus hemionus*). This was the second instance of exotic lice in tule elk (tule elk from Point Reyes have exotic lice and exhibit signs of alopecia). Exotic lice from the Lake Pillsbury sample are different from those sampled at Point Reyes, and from those associated with alopecia in black-tailed deer. The Department reexamined elk in the Unit for lice in 2017 and found no specimens. Little is known about the significance of exotic lice in tule elk and further monitoring is warranted.

Non-hunting mortalities from disease, predation, poaching, roadways, and other natural causes likely have occurred within the Unit. These mortality factors are unquantified, but have not prohibited population growth for the Unit as a whole.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) enhance elk habitat and populations; and 2) enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population in the Unit is increasing, and has not reached the upper population identified in Objective 1.7. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Since 2002, the Department, Rocky Mountain Elk Foundation (RMEF), and the Mendocino National Forest have cooperated to manage elk within the Unit, with the primary goals of increasing population numbers where appropriate, and improving habitat conditions. However, the population at the Lake Pillsbury Basin is above carrying capacity, and population increases there could negatively affect habitat conditions. The Department will work to stabilize elk numbers in consideration of existing habitat conditions in this area. This will involve a moderate level of regulated elk hunting that still promotes natural range expansion to areas outside of the Lake Pillsbury Basin.

Enhancing elk habitat to promote early seral vegetation is critical to increasing elk populations. Disturbances such as fire within forested communities, or other habitat improvement projects, promote a mix of habitat types and successional stages, including forest openings and meadows, which benefit elk. To achieve these objectives, the Department will collaborate with state and federal agencies, Tribes, and private landowners.

Objective 1.1. Continue and complete projects to estimate population abundance, distribution, habitat use, and demographics by 2024, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue to affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.2
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Continue population monitoring with yearly ground surveys (and augmented with aerial surveys every third year). Ongoing.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% by 2028, where compatible with habitat capacity.

Action 1.2.1
Coordinate with public land agencies to identify habitat enhancement projects to benefit elk. Ongoing.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, California Department of Forestry and Fire Protection, NGOs, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies to identify specific areas for prescribed burns that benefit elk. Ongoing.

Action 1.3.4
Participate in landscape-level planning efforts, to the extent possible, to identify potential impacts and make recommendations to benefit elk and elk habitat. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2025.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2023.

Objective 1.5. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Determine the prevalence and significance of exotic lice on tule elk by 2025.

Action 1.6.1
Collaborate with USFS on examining elk for the presence of exotic lice. Ongoing.

Objective 1.7. Maintain a population of 100-250 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.7.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population while not impacting existing habitat conditions. Ongoing.

Action 1.7.2
Review data on an annual basis and adjust population objectives as needed, as more information is collected through monitoring, management, and research. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study. Management actions are currently needed for the increasing elk population utilizing the Lake Pillsbury Basin that may be exceeding the carrying capacity.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only)

can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take.

Objective 2.1. Increase elk hunting opportunities by at least 10% by 2023, where feasible and compatible with population objectives.

Action 2.1.1
Complete a new elk hunting environmental document that will analyze additional hunting opportunities. Expected completion: 2020.

Objective 2.2. Work with the USFS and NGOs to install or update one elk interpretive sign by 2024.

Action 2.2.1
Meet with the USFS to evaluate the possibility of adding and/or updating an elk interpretive sign. Expected completion: 2022.

Objective 2.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Herd Viability

There is potential for the natural interchange of elk from the Unit with animals from the East Park, Cache Creek/Bear Valley, and Mendocino units, each of which is adjacent to the Lake Pillsbury Unit. The Department has not detected movement between these units based on monitoring of animals recently equipped with GPS and/or VHF transmitters; however, such movements occurred when tule elk were translocated to Lake Pillsbury.

During the last 10 years, population numbers for the Lake Pillsbury herd increased to a level that supports limited public hunting and a conservative harvest. Monitoring herd performance for the next several years will be important to determine population changes along with changes in distribution and range.

The Lake Pillsbury Ranch (a private subdivision along the northern boundary of the Lake Pillsbury Basin originally intended to provide vacation residences), is increasing in year-long occupancy. There is a potential for private property conflicts with elk to

increase as more houses are built and the Lake Pillsbury Ranch expands. Additionally, an unpaved airstrip in the Gravelly Valley is used by private pilots and not fenced, and could pose a safety hazard for plane/elk collisions. Finally, Off Highway Vehicle use in the Lake Pillsbury Basin is another human activity that could harass and/or displace elk. Other limiting factors, problems, threats and challenges for this herd are unknown and continued monitoring is warranted.

Summary of Annual Harvests

The Fish and Game Commission authorized annual public elk hunting within the Unit in 2010 (Table 2). Annual quotas are conservative and hunter success has been high. Elk hunting under the Private Lands Management (PLM) program currently does not occur within the Unit. Similarly, there has been no harvest under Cooperative Elk Hunting. It is anticipated that future opportunities through the PLM program and Cooperative Elk Hunting will be minimal for the Unit, and that most of the harvest will continue to result from public elk hunting.

Limited information is available regarding ages of elk taken by public hunting for the Lake Pillsbury Unit. Mean age of antlered elk ranged from 6.0-10.0 years from 2010-2015, whereas mean age of antlerless elk ranged from 2.0-6.0 years.

The annual harvest constitutes approximately 3% of the population (Table 2). A potential future population management strategy could involve increasing annual tag quotas for bulls and antlerless elk, as population trends still appear to be increasing. Adding additional hunt periods also may be warranted. This would maintain hunt quality and manage hunter crowding.

Unit Highlights

Collaboration between the Department, USFS, and RMEF has improved habitat conditions and contributed to population growth for the Unit, especially since 1999. A partial description of these collaborative management activities follows:

- The Department collaborated with RMEF and Mendocino National Forest to improve habitat in the Lake Pillsbury Basin. To date, habitat enhancement on about 500 acres has occurred; specific projects completed include prescribed burning, mechanical manipulation of brush (e.g., mastication, crushing and piling with dozers), and installation of interpretive signs to inform the public about elk in the Unit.

- Since 2005, 19 individual elk were equipped with VHF and GPS transmitters to monitor their movement, distribution, and habitat use within the Unit.

- Beginning in 2016, the Department initiated a comprehensive study utilizing GPS collars and fecal DNA collection.

Elk have done well within the Lake Pillsbury Basin and habitat improvement efforts should be expanded to other locations within the Unit where elk might benefit.

Literature Cited

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Data Tables/Figures

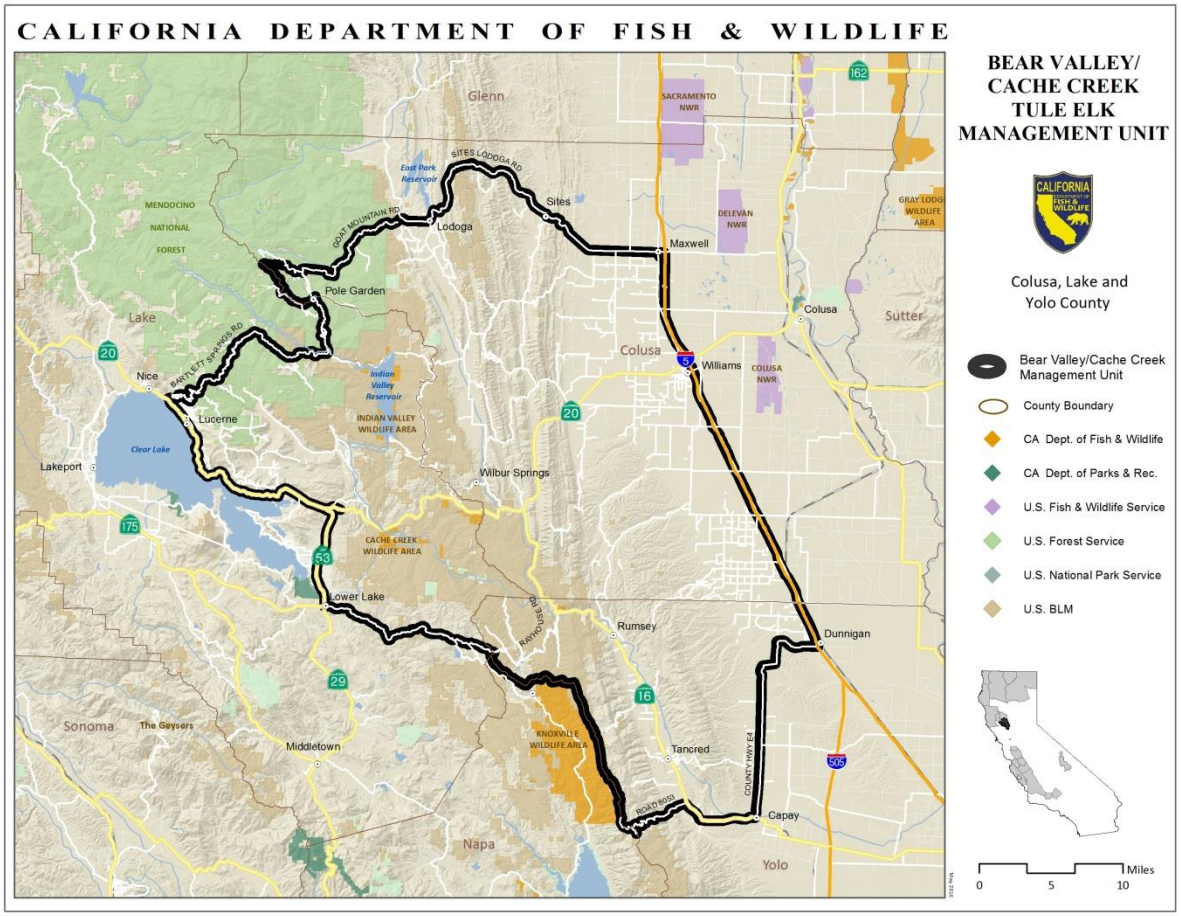
Table 1. Tule Elk Surveys for the Lake Pillsbury Tule Elk Management Unit, 2005 – 2016.

Date	Number of Elk Observed					Survey Mode	Notes
	Bulls	Cows	Calves	Not Classified	Total		
April 29. 2005	16	35	10		61	Ground	Source: CDFW Files. S. Koller
April 23-24, 2008	20			30+	50+	Ground	Apr. 23-24, 2008 Field Notes, L. Morgan, USFS.
Sept. 22-24, 2009				82+	82+	Ground	Sept. 22-24, 2009 Field Notes, L. Morgan, USFS.
April 22, 2010	27	51	7	0	85	Ground	Apr. 22, 2010 Field Notes, L. Morgan, USFS.
June 22-23, 2011	22	46	29	6	103	Ground	Source: CDFW Files. Combined totals for surveys performed on 6/22/11 and 6/23/11.
Sept. 17, 2011	42	1		89	132	Ground	Sept. 17 Field Notes, L. Morgan, USFS. Animals not classified were primarily cows and calves.
Aug. 16, 2012	13	48	11	0	72	Ground	Source: CDFW Files.
Aug. 17, 2012	15	82	20	0	117	Ground	Source: CDFW Files. Replicate of Aug. 16, 2012 survey.
Aug. 29, 2012	31	93	4	0	128	Ground	Source: CDFW Files.
Aug. 30, 2012	19	64	16	0	99	Ground	Source: CDFW Files. Replicate of Aug. 29, 2012 survey.
May 6, 2013	23	57	2	0	82	Ground	Source: CDFW Files.
May 7, 2013	6	12	2	67	87	Ground	Source: CDFW Files. Replicate of 5/6/13 survey.
April 21, 2014	32	69	1	0	102	Ground	Source: CDFW Files.
April 22, 2014	32	83	0	0	135	Ground	Source: CDFW Files. Replicate of April 21, 2014 survey.
January 29, 2015	1	6	0	0	7	Ground	Source: CDFW Files.
May 18, 2015	0	0	12	92	104	Ground	Source: CDFW Files.
June 15, 2015	25	73	23	0	121	Ground	Source: CDFW Files.
August 29, 2016	15	85	21	0	121	Ground	Source: CDFW Files.
April 24-25, 2017	8	84	2	0	94	Ground	Source: CDFW Files.

Table 2. Lake Pillsbury Tule Elk Hunt, Tag Quotas and Harvests, 2010-2016.

Year	Bull		Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest
2010	2	2	2	2
2011	2	2	2	2
2012	2	2	3	3
2013	2	2	3	3
2014	2	2	4	4
2015	2	2	4	4
2016	2	2	4	4
Totals	**14**	**14**	**22**	**22**
Success Rate	**100%**		**100%**	

Cache Creek/Bear Valley Tule Elk Management Unit



Cache Creek/Bear Valley
Tule Elk Management Unit

Description

The Cache Creek portion of the Cache Creek/Bear Valley Tule Elk Management Unit (Unit) consists of those portions of Lake, Colusa and Yolo counties within the following line: beginning at the junction of Highway 20 and Highway 16; south on Highway 16 to Reiff-Rayhouse Road; west on Reiff-Rayhouse Road to Morgan Valley Road; west on Morgan Valley Road to Highway 53; north on Highway 53 to Highway 20; east on Highway 20 to the north fork of Cache Creek; north on the north fork of Cache Creek to Indian Valley Reservoir; east on the south shore of Indian Valley Reservoir to Walker Ridge-Indian Valley Reservoir Access Road; east on Walker Ridge-Indian Valley Reservoir Access Road to Walker Ridge Road; south on Walker Ridge Road to Highway 20; east on Highway 20 to the point of beginning.

The Bear Valley portion abuts the northern and eastern boundaries specified above and consists of portions of Colusa, Lake, and Yolo counties within a line beginning in Colusa County at the junction of Interstate Highway 5 and Maxwell Sites Road at Maxwell; west along Maxwell Sites Road to the Sites Lodoga Road; west along the Sites Lodoga Road to Lodoga Stonyford Road; west along Lodoga Stonyford Road to Goat Mountain Road; west and south along Goat Mountain Road to the Colusa-Lake County line; south and west along the Colusa-Lake County line to Forest Route M5; south along Forest Route M5 to Bartlett Springs Road; east along Bartlett Springs Road to Highway 20; east on Highway 20 to the fork of Cache Creek; north on the north fork of Cache Creek to Indian Valley Reservoir to Walker Ridge-Indian Valley Reservoir Access Road; east on Walker Ridge-Indian Valley Reservoir Access Road to Walker Ridge Road; south on Walker Ridge Road to Highway 20; east on Highway 20 to Highway 16; south on Highway 16 to Rayhouse Road; south and west on Rayhouse Road to the Yolo-Napa County line; east and south along the Yolo-Napa County line to Road 8053; east on Road 8053 to County Road 78A; east on County Road 78A to Highway 16; east on Highway 16 to Route E4 at Capay; north and east on Route E4 to Interstate Highway 5; north on Interstate Highway 5 to the point of beginning.

The Unit includes about 1.1 million acres within the North Coast and Klamath, and the Central Valley and Sierra Nevada Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). Elevation ranges from 900 ft. at Wilson Valley (Cache Creek) to over 2,833 ft. along Cortina Ridge. Summer daytime temperatures can exceed 100º F. Large areas of undisturbed, typical interior coast range vegetation exist within the Unit, dominated by chamise chaparral, mixed chaparral, serpentine chaparral, annual grasslands, and oak woodland/savannah. The terrain is rugged, with many steep ridges and narrow valleys.

About 15% of the Cache Creek portion of the Unit is public land, 20% of the Bear Valley portion is public. Public land is administered by United States Department of Interior Bureau of Land Management (BLM), the State of California, and Yolo County. Because of recent land acquisitions (e.g., Payne Ranch, Destanella Flats, Pluth Ranch), much of the Cache Creek portion that contains elk is public land and accessible. Private land in the Unit is used for grazing and agriculture. Recreational activities involving elk within the Unit include viewing/nature study, photography, hunting, and shed collecting.

Elk Distribution and Abundance

The oldest free-ranging tule elk (*Cervus canadensis nannodes*) herd in the state, the Cache Creek herd was established in 1922 when 21 elk from Del Monte Park (Monterey County) were released near the intersection of highways 16 and 20 in Colusa County. Three primary subherds have been identified within the Unit: Wilson Valley, Bear Creek and Cortina Ridge (California Department of Fish and Game 1988). The Wilson Valley and Bear Creek subherds are within the Cache Creek portion of the Unit, whereas the Cortina Ridge subherd is within the Bear Valley portion.

The California Department of Fish and Wildlife (Department) has periodically used VHF and GPS radio transmitters to monitor elk within the Unit since 1984. Numerous aerial and ground surveys have occurred over the years (Table 1). These surveys provide a minimum population level and recruitment rates. From 1988-2010, the Department monitored the elk population within the Unit using helicopter surveys, which were optimal because of topography and vegetation. Helicopter surveys, which were cancelled in 2010, resumed in 2016 and alternative monitoring techniques (such as fecal DNA) are currently being developed which may assist in replacing the helicopter as a primary survey tool for this Unit. The intent is to maintain and enhance a stable elk population in balance with habitat conditions. The 1988 management plan for the Unit specified a minimum population of 150 elk for the Cache Creek unit (California Department of Fish and Game 1988). With range expansion into the Bear Valley portion of the Unit, a minimum of 150-200 elk should be maintained in this area. The population estimate for the Unit is 350 elk based upon the current monitoring efforts.

Tule elk have been reestablished within the Unit for more than 90 years. Forage production appears limited by dry summer conditions; limited availability of wetlands and associated grasslands/uplands likely precludes further population growth. Non-hunting mortalities from predation, poaching, and roadways have been documented and should be quantified for the Unit.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition

that the Department and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 4) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The Department considers the elk population in the Unit to be stable/increasing. It has not reached the upper population identified in Objective 1.6. Elk population numbers within the Cache Creek area appear to be stable, whereas elk within the Bear Valley zone appear to be increasing. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Population management for this Unit involves efforts to increase elk numbers where suitable on public lands, while working to reduce or stabilize elk numbers in conflict areas. It will involve a conservative level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict, and targeted elk hunting and depredation relief in areas where reoccurring conflict with agriculture and humans exists. Expansion of elk use of private lands where elk are tolerated is one method to successfully increase elk populations. Private lands where the presence of elk may be tolerated or encouraged include timberlands and other properties where elk are desired by the landowner. Where suitable unoccupied elk habitat exists, management actions should facilitate natural dispersal or, through translocations, reestablish elk where conflicts will be minimal.

Numerous habitat improvement projects were specified in the 1988 management plan and many projects and land acquisitions have since been completed. However, habitat degradation continues as the biggest management challenge. Decadent chaparral, invasive non-native grasses such as medusahead (*Taeniatherum caput-medusae)* and barbed goat grass (*Aegilops triuncialis*), and yellow star-thistle (*Centaurea solstitialis*) exist throughout the Unit. Cutting of oaks and other hardwoods for firewood has been extensive. While livestock grazing has been reduced in some areas, meadows and riparian areas remain especially vulnerable to grazing. Wildfires pose an additional threat by facilitating invasive, non-native grasses. Climate change may exacerbate this threat as the frequency of wildfire in California increases (Krawchuk and Moritz 2012).

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire (where the presence of invasive non-native grasses would be minimized) or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with state and federal agencies, Tribes, and private landowners.

Objective 1.1. Continue and complete monitoring projects to determine population abundance, distribution, habitat use, and demographics by 2024, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue to affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to determine seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.2
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Continue population monitoring with helicopter surveys (augmented, as necessary, with ground surveys). Ongoing.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2023.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Action 1.2.3
Coordinate with public land agencies, Tribes, and non-governmental organizations and establish a timeline to evaluate the potential for elk translocations. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, United States Department of Agriculture Forest Service, California Department of Forestry and Fire Protection, California Department of Parks and Recreation, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance elk habitats, such as meadows and riparian areas. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.5
Coordinate with BLM to control invasive plants (non-native medusahead, barbed goat grass and yellow star-thistle). Support use of herbicides on the Bear Creek Ranch (within the Cache Creek portion of the Unit) to control invasive plants and continue planting/enhancing native vegetation. Ongoing.

Action 1.3.6
Coordinate with BLM to continue restrictions on livestock grazing to improve water infiltration/retention and the condition of riparian areas. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2025.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2023.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 150-450 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes.

Identified issues include; the need to assess the number and composition of elk populations; the need for habitat restoration; the significance of potential limiting factors affecting elk management; and the potential for translocation of elk onto tribal land. The Department is committed to working with Tribes on enhancing elk habitat.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes for the development of co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Objective 2.2. Work with Tribes to complete monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat by 2023.

Action 2.2.1
Collaborate with interested Tribes to identify monitoring and habitat projects and establish a timeline for implementation. Expected completion: 2019.

Action 2.2.2
Coordinate with interested Tribes to identify Department approved research projects utilizing GPS collars to assess habitat use. Expected completion: 2023.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One option is to allocate private-land-only tags that focus harvest on

private property to alleviate conflicts and reduce hunting pressure on elk inhabiting public lands.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits. Other projects to improve public hunting access on private land have yet to be implemented within the Unit, but as additional landowners learn about the SHARE program, public access opportunities for elk hunting may increase. Tribes have expressed interest in the SHARE program and in increased coordination with the Department in elk management efforts.

Objective 3.1. Increase elk hunting opportunities by at least 10% by 2023, where feasible and compatible with population objectives.

Action 3.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities and the potential to divide the Unit into smaller hunt zones. Expected completion: 2020.

Action 3.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Objective 3.2. Work with BLM and NGOs to install/update one elk interpretive sign by 2024.

Action 3.2.1
Meet with BLM to evaluate the possibility of adding and/or updating an elk interpretive sign. Expected completion: 2022.

Objective 3.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program currently is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts.

Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve their tolerance of elk. Through Cooperative Elk Hunting, Private Lands Management (PLM), and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting and co-management with Tribes to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

Objective 4.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 4.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs once established. Ongoing.

Action 4.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

There is potential for the natural interchange of individuals from the Cache Creek/Bear Valley, Lake Pillsbury, and East Park Reservoir units. In 2007, GPS collars were attached to elk in the East Park Reservoir and Lake Pillsbury units to monitor elk movements. Minimal movements outside of respective unit boundaries were detected although several collars were never recovered and may have failed. Sample size was small and additional monitoring may be needed to detect natural movement and genetic exchange between these management units.

Although natural interchange has been minor between adjacent units, the Department has periodically moved individuals and small groups of elk into the Unit from the San Luis National Wildlife Refuge, Tupman Tule Elk State Reserve, and Concord Naval Weapons Station (Table 2). These actions contribute to genetic diversity and should continue opportunistically as funding allows and surplus animals are available.

The Cache Creek/Bear Valley tule elk herd has persisted for more than 90 years and population numbers appear stable. Periodic translocation of individuals into the Unit contributes to genetic diversity and the elk population is viable under existing conditions. A specific upper limit based on biological factors has not been determined. Current habitat conditions in the Cache Creek area appear marginal and would not likely support significant population growth.

Summary of Annual Harvests

The elk population is stable and limited by habitat conditions. The current harvest strategy involves low tag quotas and a harvest of predominantly bulls to have minimal impact on population size.

The Fish and Game Commission authorized annual public elk hunting within the Cache Creek portion of the Unit starting in 1989. Tag quotas and harvests for the Cache Creek portion are listed in Table 3. In 2010, the Commission authorized public elk hunting within the Bear Valley portion of the Unit (Table 4). Antlerless tags were not issued from 1992-1999. Cumulative harvest for the entire Unit disproportionately favors bulls. Harvest quotas are conservative; the 2015 harvest was less than four percent of the total elk counted during the 2016 survey of the Unit.

Cooperative Elk Hunting has not occurred within the Unit. However, from 1996-2001, the Commission authorized hunting under the PLM program for two ranches within the Cortina Ridge subherd boundaries. The reported harvest was 15 bulls and 12 antlerless elk. Tule elk hunting under the PLM program currently does not occur within the Unit.

Age of elk within the Unit has been monitored since 1989 (Figure 1). Small sample sizes limit conclusions that can be made about average (mean) age of the harvest. Mean age

of antlerless elk has varied from 1.0-10.5 years, whereas mean age of antlered elk varied from 2.0-7.5 years. Mean age is not declining and hunter success within the Unit is stable.

Unit Highlights

The Cache Creek/Bear Valley herd is the oldest free ranging tule elk herd in the State and has persisted within historical range for over 90 years. Within the Cache Creek area, population numbers may be limited by habitat conditions in some areas, which are fair to marginal. A conservative public hunting program has been maintained for over 20 years in the Cache Creek portion of the Unit. In 2010, a similar conservative hunting program was initiated in the Bear Valley portion.

The Department has monitored elk within the Unit and collaborated with land management agencies and NGOs to implement research and management activities. Below is a partial listing of these activities:

- In the mid-1980s, the Department established a contract with Humboldt State University Foundation to monitor tule elk at Cache Creek.

- In 1988, the Department prepared the Cache Creek Tule Elk Management Unit Management Plan.

- During the mid-1990s, the Department began work with RMEF and BLM to purchase or acquire conservation easements for key private parcels within the Unit. Several parcels have since been purchased (Payne Ranch, Harley Gulch, Pluth Ranch).

- Beginning in 2016, the Department initiated a comprehensive study utilizing GPS collars and fecal DNA collection. 23 GPS collars were placed on elk in the Unit.

The Department also has collaborated with universities, NGOs, and BLM to develop other monitoring and management activities within the Unit. A partial listing of these and other studies submitted to the Department includes the following:

Unit Specific Research

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Data Tables/Figures

Table 1. Elk Monitoring within the Cache Creek/Bear Valley Tule Elk Management Unit, 1922-2016.

Date	Bulls	Cows	Calves	Unclassified	Total	Bull:Cow:Calf Ratio	Survey Type
1922	21 elk translocated from Del Monte Park to Swanson Ranch, Colusa County.						
1930				60-100	60-100		Unknown
March, 1954				33	33		Fixed-wing
January, 1955				52	52		Fixed-wing
September, 1955	13	26	10	5	54		Fixed-wing and ground
March, 1956				53	53		Fixed-wing
March, 1956				36	36		Fixed-wing
July, 1956	3	14	7	0	24		Fixed-wing
						22:100:33	Ground
August, 1970				63	63		Fixed-wing
					52	59:100:18	Unknown
August, 1971				71	71		Spotlight
				39	39		Fixed-wing
						27:100:47	Unknown
					~150		Unknown
June-July, 1972	97	203	64	0	364		Unknown
1973				106	106		Unknown
March, 1973				57	57		Fixed-wing
April, 1973				66	66		Fixed-wing
May, 1973				39	39		Fixed-wing
June, 1973				38	38		Fixed-wing
1977				80-100	80-100		Unknown
1978				90	90		Unknown
1979				90	90		Unknown
1980				100-120	100-120		Unknown
1981				120	120		Unknown
1982				110	110		Unknown
1983				120	120		Unknown
1986						56:100:44	Unknown
					62	44:100:62	Unknown, Wilson Valley subherd
					45	21:100:58	Unknown, Bear Creek subherd
					97	21:100:46	Unknown, Cortina Ridge subherd
1988				375-450	375-450		Unknown
February, 1988				222	222	27:100:27	Unknown
1989				450-525	450-525		Unknown
February, 1989	19	46	19	0	84		Unknown
1991				120	120		Helicopter
1992				400-450	400-450		Unknown
March, 1992					59	32:100:24	Unknown
March, 1993					54	59:100:24	Unknown
December, 1997					65	23:100:25	Unknown
December, 1998					90	22:100:42	Unknown
December, 1999					86	25:100:26	Unknown
January, 2002					94	36:100:32	Unknown
January, 2003						34:100:55	Unknown
February, 2005	46	85	14	1	146		Helicopter
November, 2006	28	46	17	0	91		Helicopter
November, 2008	35	110	42	0	187		Helicopter
January, 2014	2	21	8	0	31		Ground
	2	27	10	0	39		Ground
	2	8	5	0	15		Ground, Bear Creek subgroup
February, 2014	4	33	5	0	42		Ground, Cortina East subgorup
	3	20	12	0	35		Ground, Cortina West subgroup
	2	34	7	0	43		Ground, Rock Quarry subgroup
	4	10	4	0	18		Ground, Bear Creek subgroup
November, 2014	4	12	7	0	23		Ground, Cortina East subgroup
	5	17	5	0	27		Ground, Cortina West subgroup
January, 2015	2	11	4	0	17		Unknown, Rock Quarry subgroup
May, 2015	1	8	5	0	14		Ground, Cortina West subgroup
June, 2015	6	47	16	0	69		Ground, Cortina West subgroup
March, 2016	23	66	23	0	112		Helicopter, Cache Creek
	57	72	22	0	151		Helicopter, Bear Valley
April, 2016	3	14	2	0	19		Ground, Payne Ranch

Table 2. Tule Elk Relocated to the Cache Creek/Bear Valley Tule Elk Management Unit, after 1922.

Date	Event
Feb. 1995	10 cow elk relocated to Cache Creek from San Luis National Wildlife Refuge (NWR).
Nov. – Dec. 1996	9 cow elk relocated to Cache Creek from Tupman.
Jan. 1998	2 cows, 3 sub-adult cows, 1 male calf, 1 female calf relocated to Cache Creek from Tupman.
Jan. 2001	2 cows, 4 bulls relocated to Cache Creek from San Luis NWR.
Jan. 2003	4 cow elk relocated to area near intersection of Hwy 16 & 20; captured near intersection of Hwy 58 & 20.
Feb. 2005	9 cows and 3 sub-adult bulls relocated to Cache Creek from San Luis NWR.
Feb. 2006	8 adult cows, 3 sub-adult cows, 1 male calf, 2 female calves, and 12 adult bulls relocated from Concord Naval Weapons Station (NWS).
Sept. 2006	1 adult bull relocated from Concord NWS, found dead the next day near release site.
Sept. 2006	1 adult bull relocated from Concord NWS. Originally relocated to Grizzly Island WA, swam back to Concord. Found dead about 1 month later near Woodland.

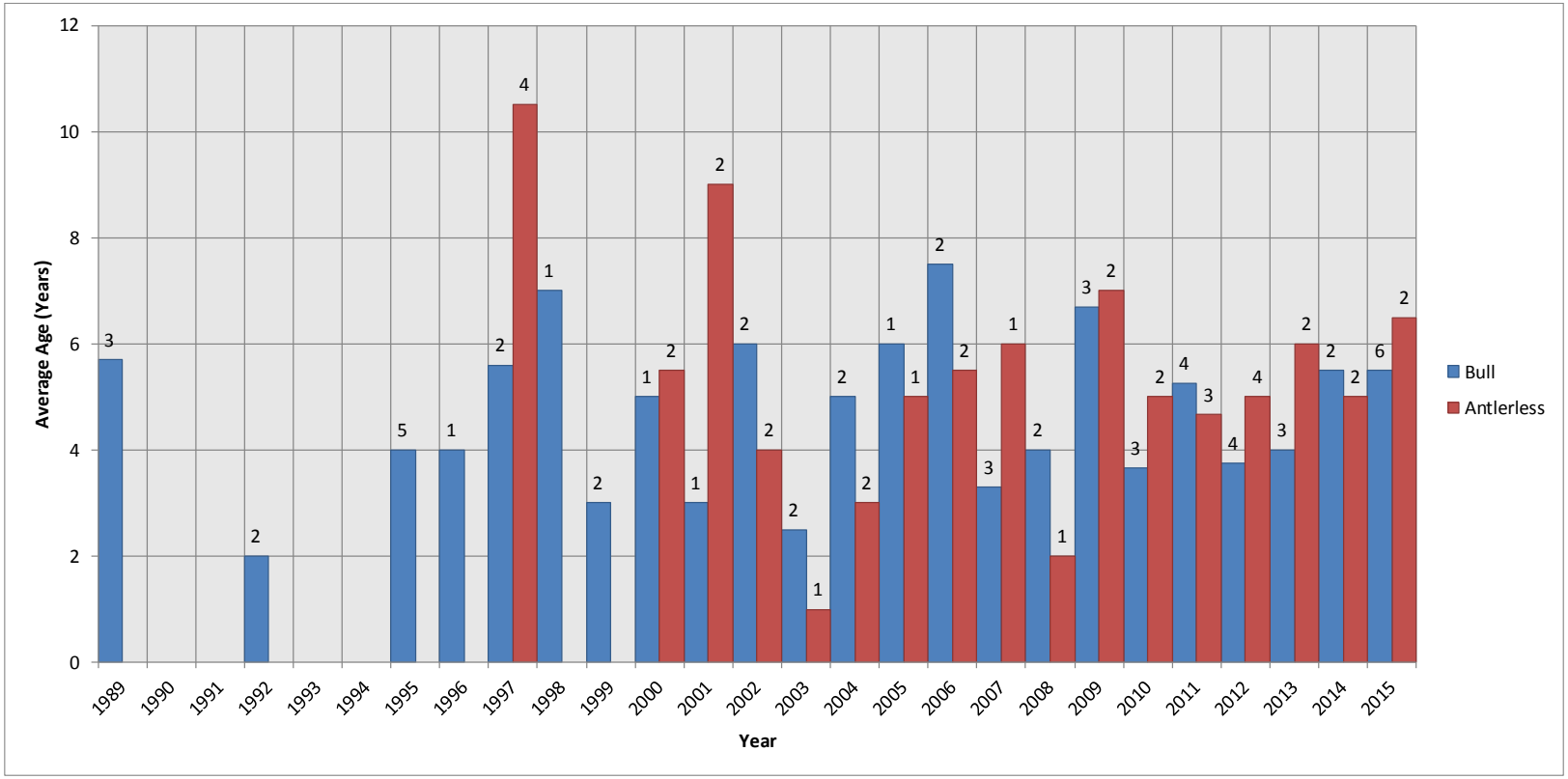
Table 3. Cache Creek Tule Elk Hunt, Public Tag Quotas and Harvests, 1989-2016.

Year	General Either-Sex			Bull		Antlerless		Apprentice Bull	
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1989	15	7	0						
1990				5	4	10	5		
1991						6	3		
1992				6	6				
1993				2	1				
1994				2	2				
1995				2	1				
1996				2	1				
1997				2	2				
1998				2	1				
1999				2	2				
2000				2	2	2	2		
2001				2	1	2	2		
2002				2	2	2	2		
2003				2	2	2	2		
2004				2	2	2	2		
2005				2	2	2	1		
2006				2	2	2	2		
2007				2	2	2	1	1	1
2008				2	2	2	2	1	0
2009				2	2	2	2	1	1
2010				2	2	2	2	1	1
2011				2	2	2	2	1	1
2012				3	2	3	3	1	1
2013				2	2	2	2	1	1
2014				2	1	2	2	1	1
2015				3	3	3	1	1	1
2016				2	2	2	2	1	1
Totals	**15**	**7**	**0**	**61**	**53**	**52**	**40**	**10**	**9**
Success Rate	**47%**			**87%**		**77%**		**90%**	

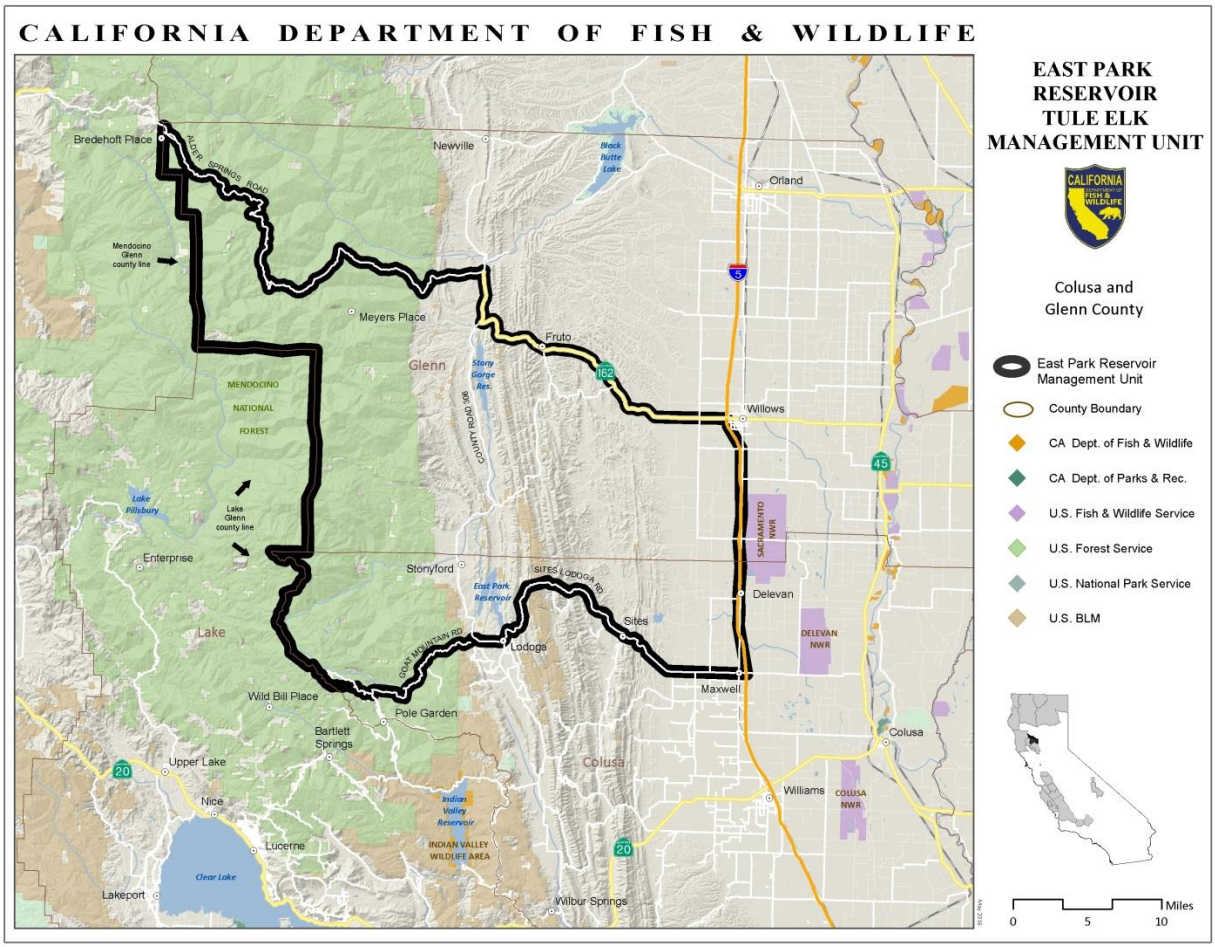
Table 4. Bear Valley Tule Elk Hunt, Public Tag Quotas and Harvests, 2010-2016.

Year	Bull		Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest
2010	1	1	1	0
2011	1	1	1	1
2012	1	1	1	1
2013	1	0	1	0
2014	1	1	1	0
2015	3	3	2	1
2016	2	2	1	1
Totals	**10**	**9**	**8**	**4**
Success Rate	**90%**		**50%**	

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting within the Cache Creek/Bear Valley Tule Elk Management Unit, 1989-2015. Sample sizes are denoted above bars for each year.



East Park Reservoir Tule Elk Management Unit



East Park Reservoir
Tule Elk Management Unit

Description

The East Park Reservoir Tule Elk Management Unit (Unit) is located in Colusa and Glenn counties on the west side of the Sacramento Valley, approximately twenty miles west of the town of Maxwell. The Unit is about 440,000 acres in size; it is bounded on the east by Interstate Highway 5 and extends west into the Coast Range. Specific boundaries are: those portions of Glenn and Colusa counties within a line beginning in Glenn County at the junction of Interstate Highway 5 and Highway 162 at Willows; west along Highway 162 (Highway 162 becomes Alder Springs Road) to the Glenn-Mendocino County line; south along the Glenn-Mendocino County line to the Glenn-Lake County line; east and then south along the Glenn-Lake County line to the Colusa-Lake County line; west, and then southeast along the Colusa-Lake County line to Goat Mountain Road; north and east along Goat Mountain Road to the Lodoga-Stonyford Road; east along the Lodoga-Stonyford Road to the Sites-Lodoga Road at Lodoga; east along the Sites-Lodoga Road to the Maxwell-Sites Road at Sites; east along the Maxwell-Sites Road to Interstate Highway 5 at Maxwell; north along Interstate Highway 5 to the point of beginning.

The Unit is within the North Coast and Klamath, and the Central Valley and Sierra Nevada Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). The Unit is within historical tule elk (*Cervus canadensis nannodes*) range as depicted by McCullough (1969). Climate is Mediterranean with hot, dry summers and mild winters. Temperatures can exceed 100° F in summer and fall below 32° F in winter. Annual rainfall is approximately 30 inches and occurs between November and April. Precipitation generally occurs as rain at lower elevations, but snow is common at higher elevations. June to October is generally dry and hot. Topography is characterized by large valleys and rolling foothills in the east part of the Unit, with steep ridges and higher peaks in the Coast Range. Elevation varies from 99 feet in the Sacramento Valley to 7,410 feet at Black Butte Mountain. Coast Range Mountain elevations tend to increase from south to north. East Park Reservoir, Stony Gorge Reservoir and Stony Creek are prominent water sources within the Unit.

Several different vegetation types are found within the Unit. In the Central Valley, agriculture is predominant with both orchards and annual croplands. The western reaches of the valley are dominated by pastures and annual grasslands. Blue oak (*Quercus douglasii*) and valley oak (*Q. lobata*) woodlands, chamise-chaparral, lacustrine, and riverine habitat types are found around East Park and Stony Gorge reservoirs. Vegetation at higher elevations is characterized by Ponderosa Pine (*Pinus ponderosa*) and Montane Hardwood-Conifer habitats.

Approximately 40% of the Unit consists of public land, administered primarily by the United States Department of Agriculture Forest Service (USFS; Mendocino National Forest) and the United States Department of Interior Bureau of Land Management (BLM; Ukiah Field Office). The United States Department of Interior Bureau of Reclamation (BOR) administers approximately 2,000 acres near East Park Reservoir that are used extensively by tule elk. The California Department of Fish and Wildlife (Department) has an agreement with BOR to offer limited public access for elk hunting (muzzleloader only) during specific four-day hunt periods in September.

Private land in the Unit is used for grazing, agricultural crops, and as primary and vacation residences. veThere have been complaints related to fence damage and competition with livestock. Recreational activities involving elk within the Unit include viewing/nature study, photography, hunting, and shed collecting. Elk hunting opportunities are limited and non-consumptive uses exceed recreational hunting.

Elk Distribution and Abundance

From 1978-1985 the Department released over 150 tule elk near Lake Pillsbury and Potato Hill in the Mendocino National Forest. Some of these animals migrated into the East Park Unit. In 1992 five elk were reported within the Unit (Bureau of Land Management 1992), and by 2004 the Unit contained approximately 70 elk with a minimum ratio of 25 bulls and 36 calves per 100 cows (California Department of Fish and Game 2004).

Elk equipped with VHF and GPS radio transmitters were monitored within the Unit from 2007 - 2011, when the transmitters stopped functioning. In 2016, Department personnel surveyed the Unit by helicopter and counted 107 elk (Table 1). Currently the Unit contains approximately 125 elk.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is increasing but has not reached the upper population target identified in Objective 1.6. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Population management for this Unit involves efforts to increase elk numbers where suitable, while working to reduce or stabilize elk numbers in conflict areas. It will involve a conservative level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict, and targeted elk hunting and depredation relief in areas where reoccurring conflict with agriculture and humans exists. Non-hunting mortalities from poaching and roadways have been documented, and it is likely that some level of predation occurs. While these mortality factors have not been quantified, they have not been sufficient to prevent population growth over the last 20 years.

Elk heavily utilize private lands, which in some areas causes conflict with landowners. Expansion of elk use of private lands where elk are tolerated is one method to successfully increase elk populations. Private lands where the presence of elk may be tolerated or encouraged include timberlands and other properties where elk are desired by the landowner. Where suitable, unoccupied elk habitat exists, management actions should facilitate natural dispersal to reestablish elk where conflicts will be minimal.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with state and federal agencies, Tribes, and private landowners.

Objective 1.1. Continue and complete projects to estimate population abundance, distribution, habitat use, and demographics by 2024, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue to affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.2
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.3
Continue population monitoring with helicopter surveys (and augmented, as necessary, with ground surveys conducted in cooperation with local landowners). Ongoing.

Action 1.1.4
Develop innovative technologies to estimate population parameters, such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2023.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, BOR, USFS, California Department of Forestry and Fire Protection, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g. predation/disease) by 2025.

Action 1.4.1
Collaborate with academia on cause-specific mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2023.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 100-200 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts and reduce hunting pressure on elk inhabiting public lands.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 2.1. Increase elk hunting opportunities by at least 10% by 2023, where feasible and compatible with population objectives.

Action 2.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 2.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Objective 2.2. Install an elk interpretive sign by 2023.

Action 2.2.1
Meet with the BOR to evaluate the possibility of adding an elk interpretive sign. Expected completion: 2021.

Objective 2.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

As the overall elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Management actions are currently needed in some areas of the Unit where private property conflicts occur and elk populations are increasing.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program is currently not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve their tolerance of elk. Through Cooperative Elk Hunting, Private Lands Management (PLM), and the SHARE program, landowners with conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

Objective 3.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 3.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of non-lethal techniques to reduce damage caused by elk.
Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation.
Ongoing.

Herd Viability

There is potential for the natural interchange of individuals from the Cache Creek/Bear Valley, Lake Pillsbury, and Mendocino management units. In 2007 and 2008, GPS collars were attached to elk from the East Park and Lake Pillsbury management units to monitor elk movements. Movements by bull elk were detected into the northern section of the Cache Creek/Bear Valley unit. Sample sizes were small and additional monitoring is needed to detect other natural movement and genetic exchange between these management units.

The Department has periodically translocated individuals and small groups of elk between management units to promote genetic diversity and manage population size where needed. These actions could occur for the Unit on an opportunistic basis as funding allows and surplus animals are available. An upper limit trigger for population size for the Unit ultimately may be based on escalating private property conflicts and/or elk damage incidents.

Summary of Annual Harvests

The Fish and Game Commission authorized annual public elk hunting within the Unit starting in 2004 (Table 2). Initial quotas provided for an equal harvest of bulls and antlerless elk. Tag quotas remain conservative and reported harvests are approximately five percent of the current population size. Until 2012, all tagholders were successful in taking elk (Table 2). Hunters have taken elk on both public and private land within the Unit. To date, hunting under the PLM program has not occurred within the Unit.

Age of elk taken by hunters within the Unit has been monitored since 2004 (Figure 1). Mean age of antlered elk ranged from 4.2–8.0 years, whereas mean age of antlerless elk ranged from 3.0–19.0 years. No age trends are apparent, in part because of small sample sizes and low tag quotas. The data strongly suggest that all bulls and most cows taken by hunters were reproductively mature and survived through multiple breeding cycles (Figure 1).

Unit Highlights

The East Park herd became established by natural dispersal; tule elk were not released within the Unit and likely dispersed from releases that occurred at multiple locations in Mendocino County starting in 1978. Tule elk have been established within the Unit for over 20 years. The population appears to be increasing as numbers have increased gradually since five elk were first reported near Stonyford in 1992. Population numbers may ultimately be limited by depredation incidents on private property and/or competition with livestock. Regulated public hunting has been in place since 2004, with conservative quotas.

The Department has monitored elk within the Unit and collaborated with land management agencies and NGOs to implement research and management activities. Below is a partial listing of these activities:

- In 2008-2009, the Department attached GPS collars to bulls and cows and monitored their movements.
- In 2016, the Department initiated a fecal DNA study that includes a portion of this Unit.
- In 2017, the Department attached 14 GPS collars to bulls and cows and is monitoring their movements.

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Data Tables/Figures

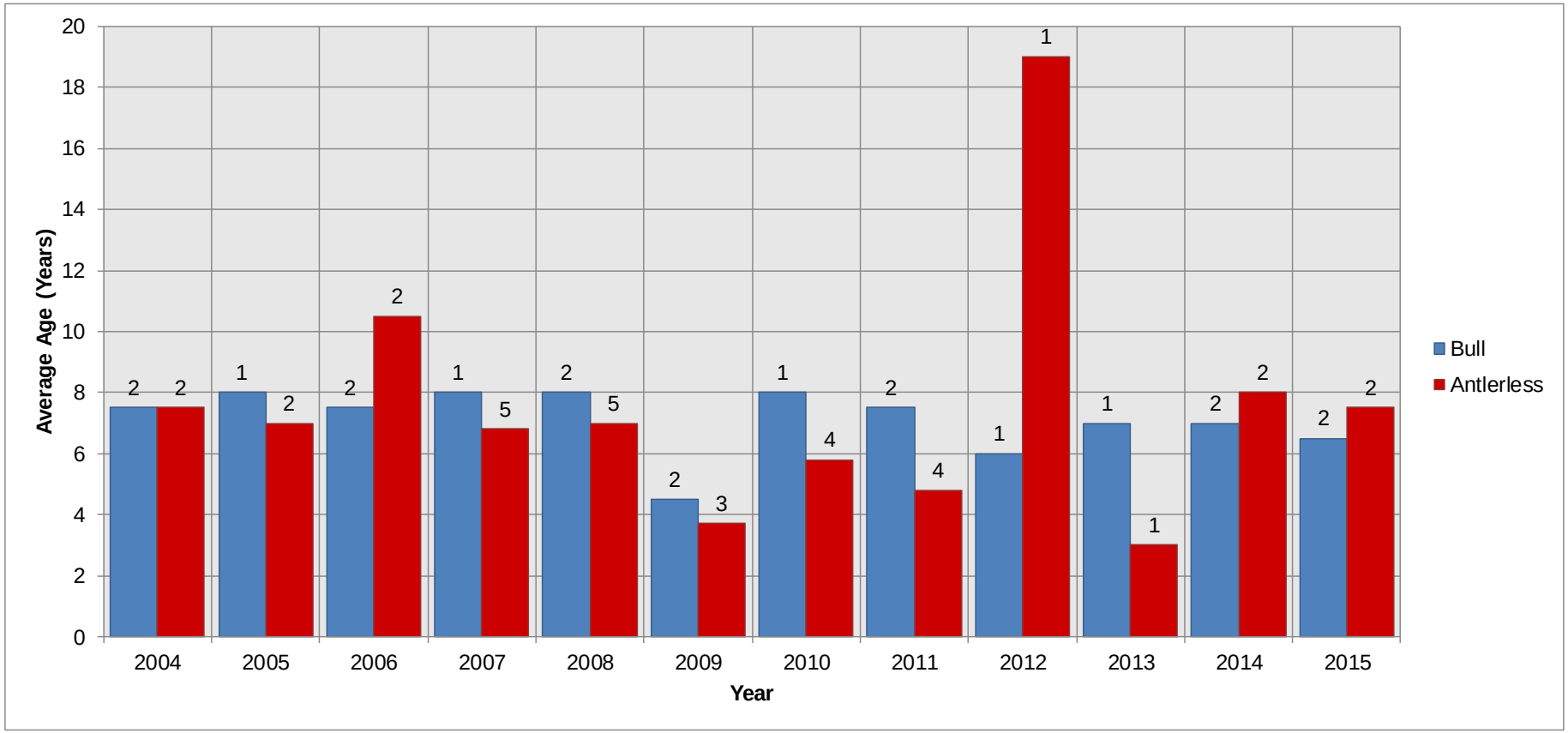
Table 1. East Park Tule Elk Management Unit Survey Results

Year	Bulls	Cows	Calves	Total
2006	35	19	15	**69**
2008	35	39	21	**95**
2016	30	59	18	**107**

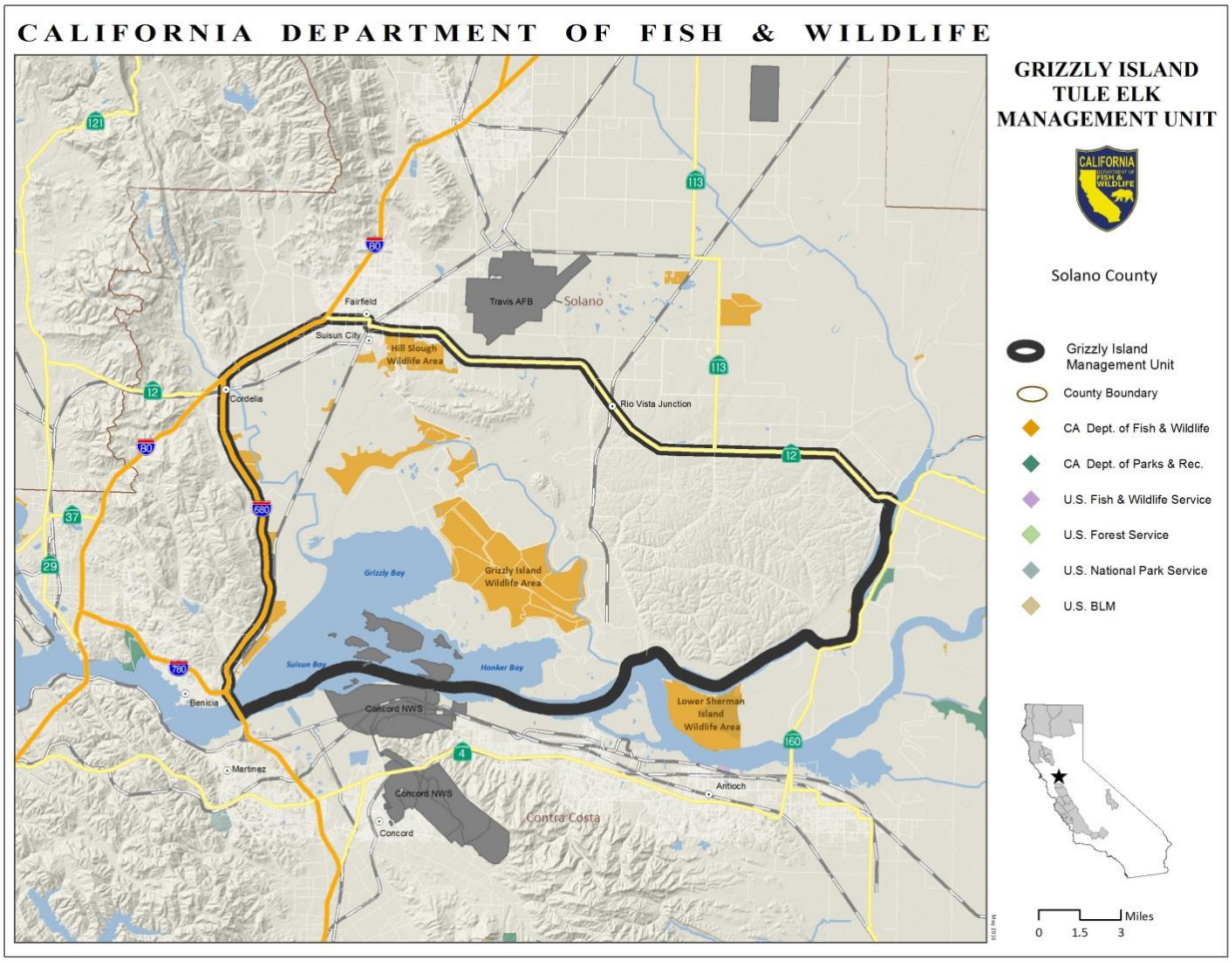
Table 2. East Park Tule Elk Hunt, Public Tag Quotas and Harvests, 2004-2016.

Year	Bull		Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest
2004	2	2	2	2
2005	2	2	2	2
2006	2	2	2	2
2007	2	2	5	5
2008	2	2	5	5
2009	2	2	4	4
2010	2	2	4	4
2011	2	2	4	4
2012	2	2	4	1
2013	2	2	2	2
2014	2	2	2	2
2015	2	2	2	2
2016	2	2	2	1
Totals	**26**	**26**	**40**	**36**
Success Rate	**100%**		**90%**	

Figure 1. Average Age of Elk Taken by Hunting within the East Park Tule Elk Management Unit 2004-2015. Sample sizes are denoted above bars for each year.



Grizzly Island Tule Elk Management Unit



Grizzly Island
Tule Elk Management Unit

Description

The Grizzly Island Tule Elk Management Unit (Unit) in Solano County is about 7 miles southeast of Fairfield, immediately north and east of the Suisun Bay. Topography is flat; elevation varies from 3 feet below to 6 feet above sea level. The Unit is within the Bay Area and Central Coast Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). Grizzly Island is within historical tule elk range as depicted by McCullough (1969).

Tule elk (*Cervus canadensis nannodes*) inhabit Grizzly Island Wildlife Area and adjacent private wetlands, grasslands, and uplands managed as waterfowl clubs. Grizzly Island Wildlife Area consists of 8,600 acres of estuarine marsh and associated uplands. It is part of an 18,000 acre complex managed by the California Department of Fish and Wildlife (Department) in the heart of the Suisun Marsh, the largest estuarine marsh on the west coast. Grizzly Island is managed primarily as seasonal wetlands and associated uplands. Levees, water control structures, and pumps have been installed and maintained to manage seasonal flooding of the ponds. Common wetland plants include: saltgrass (*Distichilis spicata*), pickleweed (*Salicornia virginica*), tules (*Scirpus* spp.), cattails (*Typha* spp.), Baltic rush (*Juncus balticus*), and fat hen (*Atriplex triangularis*). Seasonal wetlands and transitional grasslands contain dense vegetation over six feet high in some areas. Common grassland plants include: bromes (*Bromus* spp.), wild oats (*Avena* spp.), fescues (*Festuca* spp.), ryes (*Lolium* spp.), tall wheatgrass (*Elytrigia* spp.), and mustards (*Brassica* spp.). Woody vegetation consists of scattered stands of coyote brush (*Baccharis pilularis consanguinea*) and eucalyptus (*Eucalyptus* spp.) trees.

Located near San Francisco's urban center, Grizzly Island is used extensively by the public. Popular recreational activities include waterfowl, pheasant, rabbit, and elk hunting, fishing, bird watching, photography, nature viewing, dog training, and hiking. General public use (bird watching, nature viewing, photography, hiking, etc.) is allowed from February through July, and at the end of September for approximately two weeks prior to waterfowl season. Dogs are prohibited from March through June during bird nesting. Grizzly Island is open to the public from sunrise to sunset, except during waterfowl and elk seasons when access is allowed before sunrise and after sunset. Specific regulations for Grizzly Island Wildlife Area are listed in Title 14, California Code of Regulations (14 CCR § 550 and 551).

Ensuring compliance with area regulations continues to be challenging. Pedestrian access is allowed to most of Grizzly Island; however, some individuals illegally enter closed areas or drive on levees and roads that are closed to vehicles. Excessive vehicular speed is an ongoing concern on Grizzly Island Road (a gravel road

maintained by Solano County), where numerous accidents have occurred, some involving human fatalities.

Elk Distribution and Abundance

The Department translocated four bulls and three cows to Grizzly Island from Tupman Tule Elk State Reserve (Kern County) in February 1977, and a yearling cow from the Owens Valley was released later that year. One bull, one cow, and one calf were brought to augment the population during 1978 and 1979. The herd grew rapidly from this nucleus and by December 1985, it exceeded 100 animals. Initially, when the herd exceeded 100 animals, the Department captured and moved surplus elk to suitable reintroduction sites.

The initial population objective in the 1988 Grizzly Island management plan (California Department of Fish and Game 1988) was 50-70 elk. Selection of the population objective level was influenced by events from November 1985 through January 1986, when at least 15 elk died from ingesting poison hemlock (*Conium maculatum*), a common plant on levees and roads in the Suisun Marsh. The elk population exceeded 100 animals during that period and it was thought that high population size contributed to the mortalities. The management plan was revised in 1992 (California Department of Fish and Game 1992), with slight increases to the population objective, the desired bull ratio, and the minimum calf recruitment rate. Isolated mortalities have occurred since 1992 (Table 1); however, significant mortalities from poison hemlock have not been detected. The population for this Unit is estimated to be approximately 300 elk .

There are no predators of elk in the Unit (coyotes may scavenge carcasses, but have not been observed taking elk calves). Department staff, who live on site, conduct ground counts to monitor elk population numbers and determine sex and age ratios (Table 1). Additionally, the area is used intensively by the public. Thus, non-hunting elk mortalities are seldom undetected and appear to have had minimal impact on the Grizzly Island elk population.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) enhance elk habitat and populations; and 2) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is increasing and has exceeded the upper population target identified in Objective 1.4. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Population management for this Unit involves efforts to stabilize elk numbers in consideration of existing habitat conditions. Continued population expansion will result in distribution of elk into areas with high levels of conflict and roadway safety issues. Population management will involve a liberal level of regulated elk hunting. Recruitment is consistently high and non-hunting mortality low for the Grizzly Island population (Table 1). Initially, surplus animals were captured and moved to control population size. However, the need for surplus animals has diminished and regulated hunting is the primary strategy to manage population numbers. Under this strategy, annual tag quotas are recommended to achieve/maintain the population management objectives specified for the Unit. Observed parameters (e.g., total population numbers, age and sex compositions) are evaluated in light of population management objectives to develop specific quota recommendations, while considering expected calf production, hunter success from prior years, and non-hunting mortality factors.

Enhancing elk habitat is critical to maintaining healthy elk populations within this Unit. Natural disturbance promotes a mix of habitat types and successional stages that benefit elk. To achieve these objectives, the Department will collaborate with the Suisun Resource Conservation District (SRCD) and private landowners.

Objective 1.1. Continue projects to determine population abundance, distribution, habitat use, and demographics to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Ongoing.

Action 1.1.2
Continue to collect physical measurements and whole weights of harvested elk, along with tooth samples and body condition evaluations. Ongoing.

Action 1.1.3
Develop innovative technologies to determine population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Enhance or increase elk habitats by at least 5% by 2028.

Action 1.2.1
Map current elk habitat to detect change over time to guide management decisions. Expected completion: 2021.

Action 1.2.2
Meet annually with SRCD, non-governmental organizations (NGOs), and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.2.3
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.2.4
Within Grizzly Island Wildlife Area boundaries, continue planting, disking and mowing within seasonal pond areas to stimulate plant growth. Ongoing.

Action 1.2.5
Within Grizzly Island Wildlife Area boundaries, continue planting cultivated grains to improve upland fields for elk. Ongoing.

Action 1.2.6
Within Grizzly Island Wildlife Area boundaries, continue efforts to eradicate noxious weeds and undesirable invasive plants such as *Lepidium*, *Phragmites*, and yellow star-thistle (*Centaurea solstitialis)*. Ongoing.

Action 1.2.7
Evaluate the feasibility of establishing additional elk rubbing posts to reduce damage to telephone and power line poles and wildlife area signs. Expected completion: 2019.

Objective 1.3. Determine genetic diversity of the population by 2023.

Action 1.3.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples. Ongoing.

Action 1.3.2
Continue to opportunistically translocate individual elk or small groups to Grizzly Island to optimize genetic diversity. Ongoing.

Objective 1.4. Maintain a population of 150-250 elk with a minimum ratio of 50 bulls per 100 cows (80% bulls shall be branch antlered).

Action 1.4.1
Provide bull and antlerless hunting opportunities at levels that allow for a robust population level while not impacting existing habitat conditions. Ongoing.

Action 1.4.2
Maintain a minimum calf recruitment rate of 40%. Ongoing.

Action 1.4.3
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study. Management actions are currently needed for the increasing elk population that is above the population objective.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take.

The Department is evaluating the feasibility of expanding existing hunt boundaries to include property adjacent to Grizzly Island Wildlife Area. This would provide flexibility to harvest individuals from subgroups that may not utilize the Wildlife Area during the hunt periods. Subgroups that are not susceptible to population control could potentially lead to an increase in numbers and distribution outside of the Unit goals. Expanding the boundaries could also open up opportunities for landowners to enroll in the Department's Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to or through their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from

application fees for access permits. SHARE may also assist in controlling elk population numbers and managing damage/land use conflicts that involve elk on private land.

Objective 2.1. Increase elk hunting opportunities by at least 10% by 2021, where feasible and compatible with population objectives.

Action 2.1.1
Complete a new elk hunting environmental document that will analyze additional hunting opportunities. Expected completion: 2020.

Action 2.1.2
Evaluate the feasibility of expanding the hunting zone boundaries. Expected completion: 2019.

Action 2.1.3
Utilize SHARE to increase elk hunting opportunities and maintain elk populations within objectives. Ongoing.

Objective 2.2. Install/update one elk interpretive sign by 2024.

Action 2.2.1
Coordinate with the SRCD for adding and/or updating an elk interpretive sign. Expected completion: 2022.

Objective 2.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Herd Viability

Tule elk have been reestablished at Grizzly Island for more than 35 years. Based on all monitoring, the elk are in excellent physical condition. Bull to cow ratios and recruitment rates are consistently high (Table 1). Sufficient adult bulls are being retained for breeding and public viewing; and the relatively young age of cow elk suggests population vigor and the potential for continued high reproduction. Consistently high body weights are indicative of high quality habitat and stable habitat conditions.

Grizzly Island provides excellent tule elk habitat. Population size has not been limited by habitat quality/quantity; instead, population numbers are controlled with harvests that periodically meet or exceed calf production. In terms of overall viability, the Grizzly Island herd is one of the healthiest tule elk herds in the state. With additional habitat available nearby on private duck clubs and the frequent sightings by club members, it is

apparent that suitable habitat exists outside the Wildlife Area. Herd numbers currently exceed 300 animals.

Because the Grizzly Island herd is not geographically connected to any other tule elk herd (and will likely never be), the Department has periodically translocated individual animals and small groups to Grizzly Island to optimize genetic diversity (Table 1). This occurred most recently in 2013, when one adult bull, one male calf and one female calf were moved from San Luis National Wildlife Refuge to Grizzly Island. Such actions should continue as opportunities arise.

Summary of Annual Harvests

The Fish and Game Commission authorized annual tule elk hunts at Grizzly Island beginning in 1990. Public tags issued through the annual Big Game Drawing are in great demand. Annual tag quotas and harvests for Grizzly Island are listed in Table 2. Reported take of antlerless elk within the Unit is relatively high. This Unit has high recruitment and low non-hunting mortality and the take of female elk in sufficient numbers is essential if a primary objective of regulated hunting is to control population size.

Annual harvests are shown in Figure 1. Public hunting accounted for the vast majority of the reported harvest with only a small harvest under the Private Lands Management (PLM) program from 2006-2008, when the Fish and Game Commission approved tule elk hunting for the Pintail Ranch. The Pintail Ranch has since withdrawn from the PLM program. Other landowners have not joined and the PLM harvest is expected to remain comparatively small.

Tags currently are designated as antlerless, spike (yearling) bull, or bull (spike or branch antlered) tags. Designating specific quotas for antlerless and bull elk allows the harvest to be stratified by sex. For the bull harvest, some level of age stratification occurs across the yearling and adult (≥ 2 years) age classes through the designation of specific quotas for spike bulls and bulls. Hunting pressure and harvest of adult bulls can be reduced by reducing bull tag quotas, whereas recruitment of adult bulls can be increased (or suppressed) by reducing (or increasing) spike bull quotas. In 1992, an attempt was made to further stratify age of the bull harvest and facilitate take of two-year old bulls by establishing a four-point or less bull tag category. This effort was abandoned after two years when it was found that antlers of most two-year old bulls at Grizzly Island had at least five points per side.

Current tag categories and definitions are understood by the public and allow the Grizzly Island elk harvest to be stratified by sex and (for bulls) age classes. Take of calf elk (without spots) is allowed under the antlerless tag category definition (i.e., no antler longer than 4 inches), but the vast majority of antlerless tagholders selected female elk. Similarly, take of spike bulls is allowed under the bull tag category definition, but the vast majority of bull tagholders selected adult (i.e., branch antlered) bulls over yearling

bulls. Public demand for adult bull tags is high, and more than 1,000 applications are submitted for each tag issued.

Quotas and harvests in Table 2 and Figure 1 include fund-raising tags issued pursuant to Fish and Game Code section 332 (FGC § 332). Two Grizzly Island fund-raising tags per year were issued from 1990 through 2009; since then, one tag has been issued per year.

Harvests reported in Table 2 and Figure 1 include unintentional illegal take (e.g., tagholders that erroneously took two elk or that took spike bulls while possessing antlerless tags). Because unintentional illegal take was included as part of the total known harvest, on one occasion the harvest exceeded the tag quota for the spike bull category (see Table 2; year 2000). Such incidents often were self-reported by violators, whose statements to Department officers indicated their actions were unintentional. Illegal take has occurred for other elk hunts in California and in other states. Hunt orientations are mandatory at Grizzly Island to reduce incidents of unintentional illegal take.

With excellent habitat conditions and high recruitment, total elk numbers can increase quickly under a conservative harvest. From 2009-2011, the population increased by more than 20% when the harvest was less than 10 elk per year (Table 1 and Figure 2). Conversely, a liberal harvest (which averaged 37 elk per year from 2001-2006) suppressed population growth and sharply reduced herd size by the end of 2006.

Monitoring activities associated with the Grizzly Island hunt program include the following:

- Requiring mandatory tag return/reporting;
- Collecting samples from harvested elk (e.g., teeth, blood, fecal, meat/tissue, antler, ectoparasite and other samples);
- Qualitative carcass descriptions of hunter harvested elk; and
- Physical measurements of harvested elk (e.g., whole body weight, chest girth, hind foot/hoof length).

Mandatory tag return/reporting allows annual harvests and hunter success rates to be determined with precision. Tooth samples provide age information and are suggestive of the age structure of the population. Qualitative carcass descriptions, whole body weights, and other physical description indices can be suggestive of the general health of the Grizzly Island elk herd.

Average ages of branch antlered (adult) bulls and antlerless elk by year from 1990 - 2015, based on analysis of cementum annuli in tooth samples from hunter-killed elk (performed by Matson's Laboratory, Milltown, MT), are identified in Figure 2. Mean age of adult bulls ranged from 3.3-9.0 years, whereas mean age of antlerless elk ranged from 0.5-6.2 years.

Sample sizes for adult bulls often were small (Figure 2), because of conservative tag quotas and harvests (Table 2). Management objectives require maintaining sufficient adult bulls for breeding and non-consumptive viewing; thus, age structure of the adult bull portion of the Grizzly Island population is an important monitoring indicator. A declining age trend would be of concern, particularly in combination with declines in either the number of adult bulls counted and/or hunter success. Figure 2 does not suggest a declining age trend in adult bulls. Consistently high adult bull sex ratios (Table 1) and hunter success rates (Table 2) indicate the Grizzly Island population contains sufficient branch antlered bulls.

Two factors likely contributed to the young age of antlerless elk compared to branched antlered bulls. First, the antlerless elk category includes yearling females (which cannot be distinguished reliably from adult females in the field), spikes with both antlers less than 4 inches long, and male/female calves without spots (take of spotted calves is prohibited). Antlerless harvests for Grizzly Island included yearling females and male/female calves without spots. In contrast, the bull tag category definition (i.e., an elk with at least one antler longer than 4 inches) allows for the take of spike bulls; however, virtually all Grizzly Island bull tagholders selected branch antlered bulls over spikes (yearlings). Annual take of spikes is significant at Grizzly Island and a separate tag category exists (Table 2). However, yearling bulls seldom had branched antlers and thus were excluded for age analysis.

Second, the relatively young age of antlerless elk, particularly since 2006, likely resulted from intensive antlerless elk harvests that occurred from 2000-2006, which approached or exceeded calf production (Figure 2, Tables 1 and 2), and were as high as 25% of the population size. A prolonged intensive antlerless elk harvest should result in younger age class females, especially with high recruitment. Such intensive harvests were necessary to reduce population numbers to the management plan objective, and subsequently, to maintain that level.

Figure 3 contains mean whole body (i.e., ungutted) weights of adult bulls, spike bulls and antlerless elk (primarily adult and yearling females) taken at Grizzly Island from 1990-2016. Annual mean weights of adult bulls usually exceeded 700 pounds, which McCullough (1969) suggested was near the upper limit for tule elk. Mean weights of Grizzly Island antlerless elk are similar to the adjusted mean weight for Owens Valley antlerless elk (411 pounds; McCullough, 1969).

The Department also performs annual post-hunt population surveys to determine age and sex compositions and population size. Such surveys provide an indication of immediate results of the current year’s harvest program.

In addition to the activities described above, others have monitored hunter-killed elk from Grizzly Island. VanBaren et al. (1996) reported on abomasal parasites. Crawford et al. (2006) evaluated Grizzly Island tule elk for evidence of paratuberculosis. Johnson et al. (2007) collected antler and liver samples from Grizzly Island elk for comparison to samples from the Owens Valley.

Unit Highlights

Tule elk have been reestablished at Grizzly Island for more than 35 years. The herd is very healthy based on habitat conditions and examination of individual animals. Because of its proximity to the San Francisco Bay, opportunities for public use and enjoyment of the elk are high. The herd has provided surplus animals to reestablish herds in suitable historical habitat. The current need for surplus animals has diminished and regulated hunting is now used to manage population numbers. The public hunting program is extremely popular. The Department has monitored elk within the Unit and collaborated with land management agencies and NGOs to implement research and management activities. Below is a partial listing of these activities:

- California Department of Fish and Game. 1989. Grizzly Island wildlife area management plan. Unpublished report, California Department of Fish and Game, Sacramento, California, USA.

- California Department of Fish and Game. 1992. Grizzly Island tule elk management unit management plan. Unpublished report, California Department of Fish and Game, Sacramento, California, USA.

- Fowler, G.S. 1985. Tule elk in California: history, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California Berkeley, USA.

The Department has collaborated with universities, NGOs, and other agencies to develop monitoring and management activities within the Unit. A partial listing of these and other studies submitted to the Department includes the following:

Unit Specific Research

Crawford, G.C., M.H. Ziccardi, B.J. Gonzales, L.M. Woods, J.K. Fischer, E.J.B. Manning, and J.A.K. Mazet. 2006. *Mycobacterium avium* subspecies *paratuberculosis* and *Mycobacterium avium* subsp. *avium* infections in a tule elk (*Cervus elaphus nannodes*) Herd. Journal of Wildlife Diseases 42:715-723.

Johnson, H.E., V.C. Bleich, and P.R. Krausman. 2007. Mineral deficiencies in tule elk, Owens Valley, California. Journal of Wildlife Diseases 43:61-74.

Van Baren, D.C., E.P. Hoberg, and R.G. Botzler. 1996. Abomasal parasites in tule elk (*Cervus elaphus nannodes*) from Grizzly Island, California. Journal of the Helminthological Society of Washington 63:222-225.

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14 CCR § 550.

14 CCR § 551.

California Department of Fish and Game. 1988. Grizzly Island tule elk management unit management plan. Unpublished report, California Department of Fish and Game, Sacramento, USA.

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California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

Crawford, G.C., M.H. Ziccardi, B.J. Gonzales, L.M. Woods, J.K. Fischer, E.J.B. Manning, and J.A.K. Mazet. 2006. *Mycobacterium avium* subspecies *paratuberculosis* and *Mycobacterium avium* subsp. *avium* infections in a tule elk (*Cervus elaphus nannodes*) Herd. Journal of Wildlife Diseases 42:715-723.

FGC § 332.

Johnson, H.E., V.C. Bleich, and P.R. Krausman. 2007. Mineral deficiencies in tule elk, Owens Valley, California. Journal of Wildlife Diseases 43:61-74.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Van Baren, D.C., E.P. Hoberg, and R.G. Botzler. 1996. Abomasal parasites in tule elk (*Cervus elaphus nannodes*) from Grizzly Island, California. Journal of the Helminthological Society of Washington 63:222-225.

Data Tables/Figure

Table 1. Tule Elk Herd History Grizzly Island Wildlife Area, 1977-2016.

Year	Adult	Yearling	Adult	Yearling	Calves	Non-hunt Mortalities			Harvest/ Removed			Moved In			Total
	M	M	F	F		M	F	C	M	F	C	M	F	C	
1977	4	0	3	1	3	0	0	0	0	0	0	0	0	0	**11**
1978	3	0	5	3	6	0	0	1	1	0	0	0	1	1	**17**
1979	3	2	8	4	7	1	0	1	0	0	0	1	0	0	**25**
1980	5	3	12	4	11	0	0	0	0	0	0	0	0	0	**35**
1981	7	6	16	5	13	1	0	3	0	0	0	0	0	0	**47**
1982	11	5	20	8	14	2	1	1	0	0	2	0	0	0	**58**
1983	15	4	27	10	16	1	1	1	0	0	3	0	0	0	**72**
1984	12	8	36	8	24	2	1	0	6	0	0	0	0	0	**88**
1985	17	12	42	12	24	3	2	9	0	0	0	0	0	0	**107**
1986	13	12	25	12	10	1	0	0	15	29	33	0	0	0	**72**
1987	23	5	38	5	28	2	0	0	0	0	0	0	1	0	**99**
1988	19	9	22	19	24	2	0	0	7	21	12	0	0	0	**95**
1989	28	10	41	14	35	0	0	0	0	0	0	0	0	0	**128**
1990	26	15	32	18	24	4	1	0	10	22	9	0	0	0	**114**
1991	38*	1	23	12	27	11	1	0	15	25	10	0	0	0	**107**
1992	25	5	15	10	33	2	0	0	20	30	2	0	0	0	**89**
1993	25	5	13	16	23	3	1	0	16	11	1	0	0	0	**80**
1994	22	7	20	10	20	1	1	1	11	7	1	0	0	0	**79**
1995	25	9	23	11	22	3	2	2	10	5	1	3	0	0	**87**
1996	22	7	25	10	21	2	0	1	9	9	0	0	0	0	**85**
1997	20	4	28	9	31	4	1	0	10	9	0	0	0	0	**92**
1998	25	6	31	17	32	0	2	3	10	9	0	5**	3	0	**110**
1999	23	13	45	11	34	1	1	1	10	13	2	0	0	0	**126**
2000	28*	5	36	20	32	3	0	3	13	20	4	0	0	0	**121**
2001	26*	10	39	13	35	5	0	1	12	24	1	0	0	0	**123**
2002	31	6	27	21	39	1	1	0	12	22	2	0	0	0	**124**
2003	33	8	21	23	41	0	0	0	12	27	0	0	0	0	**126**
2004	36	10	25	17	32	1	1	0	12	24	2	0	0	0	**121**
2005	40	15	19	17	29	1	0	0	12	23	4	3	0	0	**118**
2006	17	6	13	7	12				8	23	2	7	0	0	**57**
2007	21	6	26	6	13	0	0	1	4	4	2	0	3	10	**78**
2008	28	8	33	7	16	2	0	0	3	5					**92**
2009* **	28	8	35	8	16	5	0	0	3	5					**95**
2010* **	29	8	46	7	17	1	0	0	2	4					**107**
2011	28	13	50	10***	17	1	0	0	2	5					**118**
2012	64	14	77	0	31	3	1	0	7	2	0				**186**
2013	64	14	61	0	27	0	0	0	7	7	1	1		2	**166**
2014	58	12	144	0	68	0	0	0	19	28	2				**282**
2015	58	23	175	0	76	1	0	0	19	37	2				**332**
2016	17	20	65	1	7	0	0	0	23	54	3				**110**

* Based on observation

** Does not include bull on Sherman Island

***Population Estimates, no survey data available

Table 2. Grizzly Island Tule Elk Hunt, Public Tag Quotas and Harvests, 1990-2016.

Year	Bull		Antlerless		Four Point or Less Bull		Spike Bull		Apprentice Spike Bull		Apprentice Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1990	10	10	20	20								
1991	4	4	20	20	9	8						
1992	11	11	6	6	6	6						
1993	5	5	12	12			9	9				
1994*	5	5	9	6			6	5				
1995	4	4	6	5			6	6				
1996	4	4	9	9			6	5				
1997	4	4	9	9			6	5				
1998	4	4	9	8			6	5				
1999	5	5	16	15			6	5				
2000**	4	4	25	24			8	8				
2001	4	4	25	25			8	8				
2002	4	4	25	24			8	8				
2003	4	4	28	27			8	8				
2004	4	4	28	26			8	8				
2005	4	4	28	27			8	8				
2006	4	3	27	24			6	5	2	2	1	1
2007	4	4	5	5					1	1	1	1
2008	4	4	5	5					1	1		
2009	4	4	4	3			1	1	1	1		
2010	3	3	2	2			2	2	1	1		
2011	3	3	2	2			2	2	1	1		
2012	3	3	2	2			3	3	1	1		
2013	5	5	8	8			3	3	2	2		
2014	5	5	28	28			11	11	2	2	2	2
2015	5	5	36	36			11	11	3	3	3	3
2016	5	5	56	54			12	11	4	4	4	4
Totals	**125**	**124**	**450**	**432**	**15**	**14**	**144**	**137**	**19**	**19**	**11**	**11**
Success Rate	**99%**		**96%**		**96%**						**100%**	

* One unsuccessful tagholder, 1 additional spike taken illegally for a total of 6 spikes harvested.

** Additional bull and spike taken illegally not included in total harvest.

Figure 1. Tule Elk Harvest within the Grizzly Island Management Unit, 1990-2016.

Sample sizes are denoted within the bars for each year.

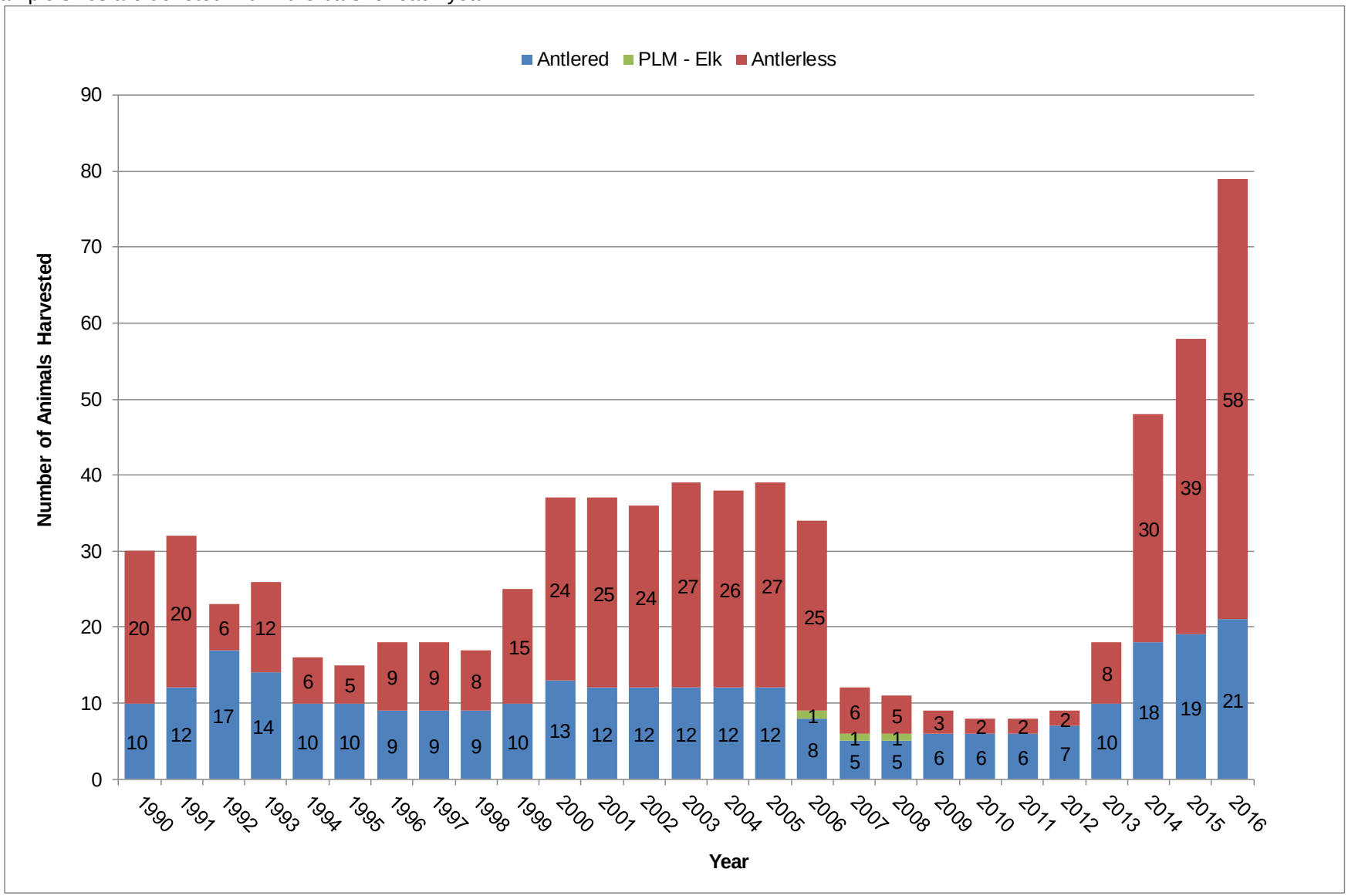


Figure 2. Average Age of Harvested Elk within the Grizzly Island Management Unit, 1990-2015.
Sample sizes are denoted above bars for each year.

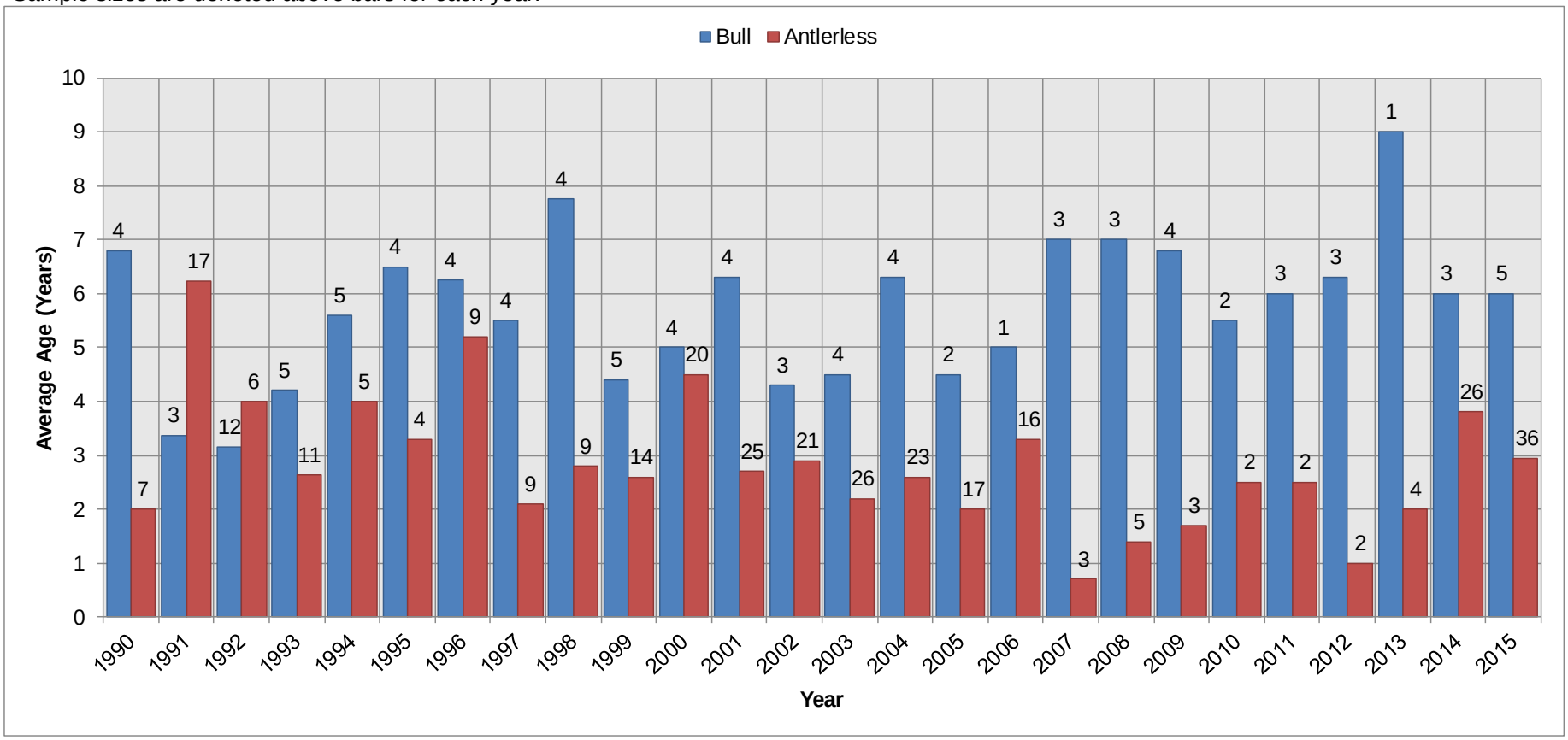
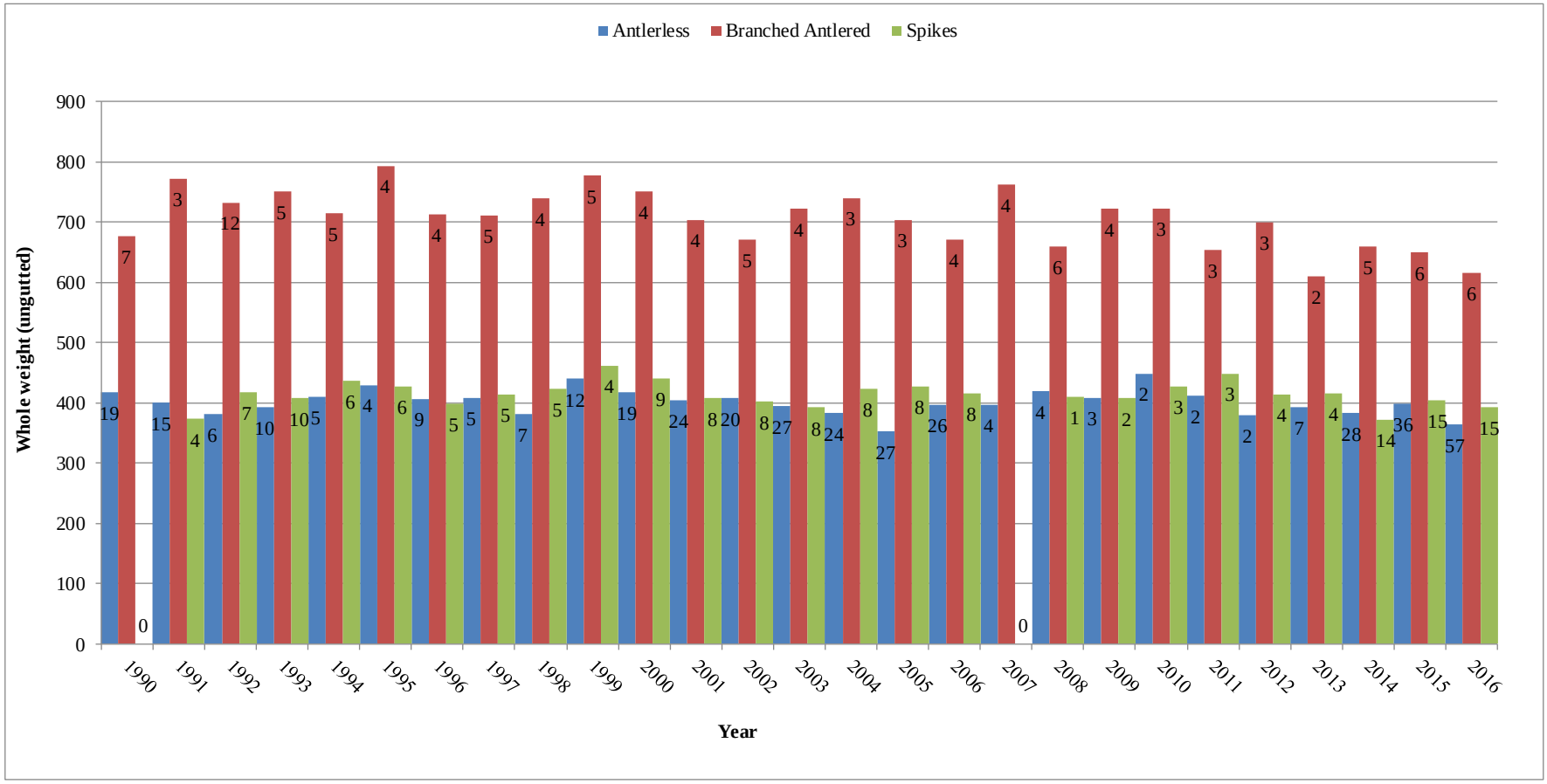
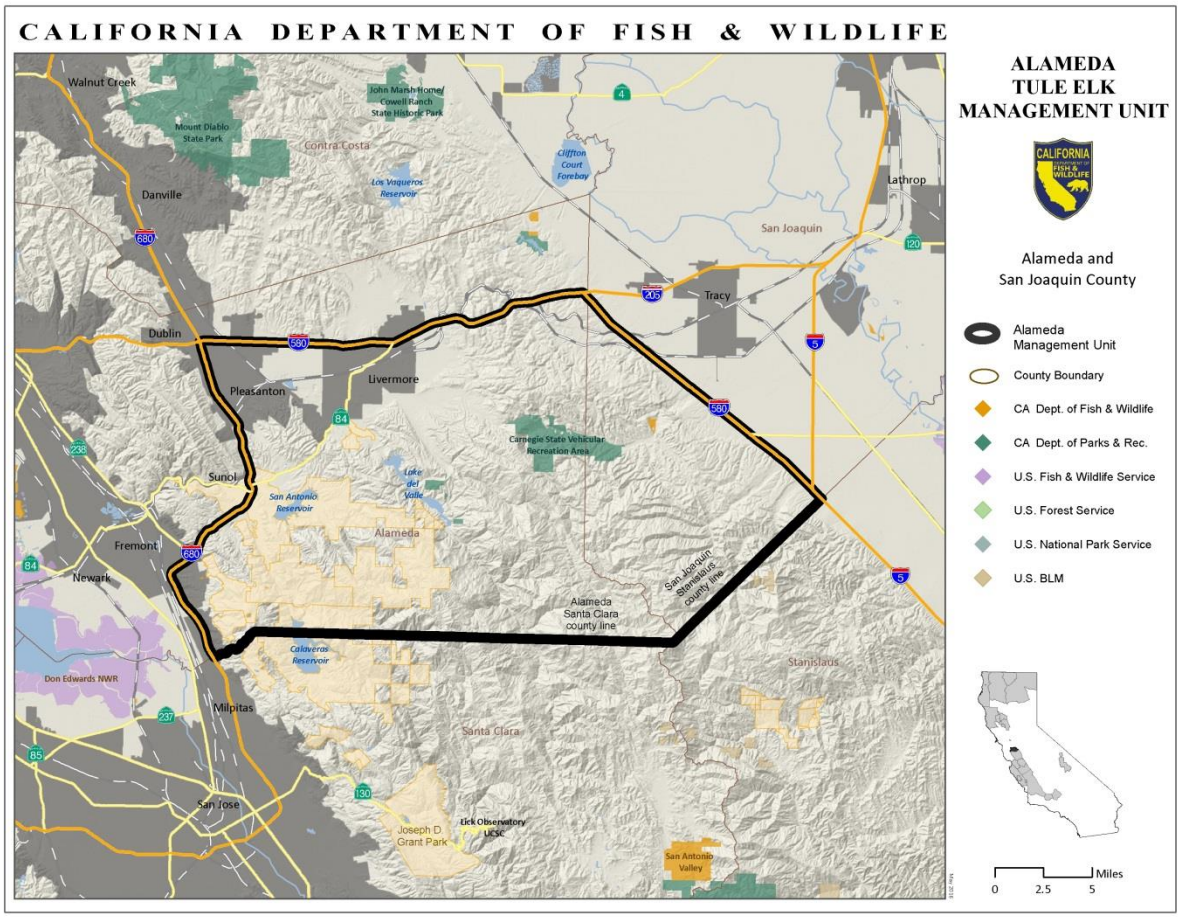


Figure 3. Average Weight (in pounds) of Hunter Harvested Tule Elk within the Grizzly Island Management Unit, 1990 - 2016. Sample sizes are denoted within the bars for each year.



Alameda-San Joaquin Tule Elk Management Unit



Alameda–San Joaquin
Tule Elk Management Unit

Description

The Alameda-San Joaquin Tule Elk Management Unit (Unit) consists of those portions of Alameda and San Joaquin counties south of Highway 580 and east of Highway 680. The Unit contains approximately 276,000 acres and is immediately north of the Santa Clara County (Mt. Hamilton) management unit. The Unit is within the Bay Delta and Central Coast Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). Vegetation consists of woodlands dominated by blue oak (*Quercus douglasii*) and interior live oak (*Q. wislizeni*), with large areas of annual grasslands and some mixed oak/gray pine (*Pinus sabiniana*) woodlands. Riparian habitat dominated by arroyo willow (*Salix lasiolepis*) is common along perennial and seasonal stream corridors. Large municipal water reservoirs are found in Alameda County. Lower elevations contain grasslands; higher elevations contain mixed oak/gray pine woodlands, some of which are invaded by junipers (*Juniperus* spp).

Tule elk (*Cervus canadensis nannodes*) occur in the Coast Ranges at elevations from 200 to 2,500 feet. Over 80% of the Unit is privately owned, but state, regional and local parks, and watersheds managed by San Francisco Water Department (SFWD) provide elk habitat. Elk are found within the Unit at or near the following locations: San Antonio Reservoir, Apperson Ridge, Sunol and Connolly-Corral Hollow ranches.

Public use of regional and local parks within the Unit involves passive recreational activities such as hiking, bicycling and horseback riding. The Department of Parks and Recreation (CDPR) administers Carnegie State Vehicle Recreational Area for off-road-vehicle ORV use.

Elk Distribution and Abundance

Sixty five tule elk from the Owens Valley were released near Mt. Hamilton in southern Santa Clara County from 1978-1981. Elk dispersed from release sites into portions of Alameda, Merced, San Joaquin, Santa Clara and Stanislaus counties and have formed four distinct subherds as follows: Horse Valley, Isabel Valley (both in Santa Clara County), San Antonio Reservoir and Alameda/San Joaquin. Additionally, since 1981, tule elk have been released at other locations in San Benito, Merced and Monterey counties.

The California Department of Fish and Wildlife (Department) has not annually monitored elk population parameters over the entire Unit. Helicopter surveys, which were cancelled in 2010, resumed in 2016 and are scheduled on a three-year rotation; these

should be augmented with ground surveys in cooperation with local land agencies and private landowners. Annual spring ground counts for the Connolly-Corral Hollow ranches ranged from a low of 38 to a high of 137 elk (Table 1). Additionally, elk were counted during Department helicopter surveys in Alameda and San Joaquin counties (Table 2). The current population estimate for the Unit is 100 elk andthe population has ranged from approximately 100 to 200 animals based on past observations and reports from landowners and public agencies.

Management Goals, Objectives, and Actions

Management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The Department considers the elk population to be in decline, primarily due to five years of drought conditions. Population management for this Unit includes efforts to increase elk numbers where suitable. Current harvest is low and considered conservative.

Currently, elk heavily utilize private lands which may cause conflict with landowners. Where elk are tolerated, expansion of elk use of private lands is one method to successfully increase elk populations. Private lands where the presence of elk may be tolerated or encouraged include woodlands, ownerships enrolled in the Private Lands Management (PLM) program, and other properties where elk are desired by the landowner. Where suitable and unoccupied elk habitat exists, management actions should facilitate natural dispersal to reestablish elk where conflicts will be minimal.

Enhancing elk habitat to induce early seral vegetation is critical to increasing elk populations. Natural disturbance, such as fire, promotes a mix of habitat types and successional stages including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with state and local agencies and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue helicopter surveys (augmented with ground surveys conducted in cooperation with local landowners). Surveys should occur on a three-year rotation. Ongoing.

Action 1.1.2
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 15% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and livestock grazing practices to benefit elk. Ongoing.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with SFWD, CDPR, California Department of Forestry and Fire Protection, NGOs, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and local agencies, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Work with PLM program participants to use prescribed fire and/or cutting to reduce juniper encroachment at higher elevations containing oak/gray pine woodlands. Ongoing.

Action 1.3.5
Work with CDPR to identify appropriate mitigation for planned expansion of the Carnegie State Vehicle Recreational Area. Deadline based on schedule for environmental review and implementation of the project.

Action 1.3.6
Collaborate with academia to collect habitat use data to identify areas utilized by elk and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.7
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.8
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease), by 2023.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2021.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 150-350 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

Providing public elk hunting opportunities within the Unit is challenging. The Unit contains enough elk to support public hunting, but elk reside on private land, and lands not open to hunting and generally inaccessible to the public. Regional and local parks prohibit hunting, and public access for regulated hunting only occurs on private ranch lands. General elk hunting was suspended within the Unit in 2011 due to access issues and elk distribution. Current elk harvest is one bull per year through the PLM program.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only)

can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits. Other projects to improve public hunting access on private land have yet to be implemented within the Unit, but as additional landowners learn about the SHARE program, public access opportunities for elk hunting may increase. Private land is essential to the survival of tule elk within the Unit.

There is a potential for agricultural/private property conflicts, thus the current population management strategy utilizes limited hunting to provide landowners an incentive to accommodate the needs of tule elk. The current harvest strategy has not yet emphasized controlling population numbers, as private property conflicts to date have been minor.

Objective 2.1. Maintain elk hunting opportunities where compatible with population objectives.

Action 2.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Objective 2.2. Work with state and local agencies and NGOs to install one elk interpretive sign by 2024.

Action 2.2.1
Meet with state and local agencies to evaluate the possibility of adding an elk interpretive sign. Expected completion: 2021.

Objective 2.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

To date, human-elk conflicts have been minimal. If the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Periodic complaints have involved competition with livestock for forage and fence damage. The PLM program has provided an incentive for participants to modify livestock grazing and otherwise accommodate elk within the Unit. Additionally, elk fence crossing structures can be installed in areas where fence damage is attributed to elk.

However, if elk distribution expands or population numbers increase, damage and agricultural conflicts could escalate. Controlling population numbers and damage/land use conflicts with regulated hunting may become more challenging because of the prevalence of private land within the Unit. The SHARE program is a potential population management strategy that can improve public access to private (or landlocked public) land. The SHARE program may also assist in controlling elk population numbers and managing damage/land use conflicts that involve elk on private land.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program, currently, is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve their tolerance of elk. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

<u>Objective 3.1. Continue to monitor human-elk conflicts on private property.</u>

Action 3.1.1
Map areas of human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Elk reoccupied the Unit as a result of dispersal from the Mt. Hamilton area in Santa Clara County. It is plausible that natural interchange with the Santa Clara unit to the south can occur and there is a potential for exchange of individuals between San Joaquin and Alameda counties. Elk have persisted within the Unit for decades and continue to be found in the same general areas (e.g., Sunol, San Antonio Reservoir, Connolly-Corral Hollow ranches). Survey results suggest some variation in population numbers, but it is unclear whether such surveys are indicative of actual fluctuations in the population.

Highways 580 and 680 provide barriers to elk dispersal to the north and west; historical habitat immediately north and west of these barriers no longer contains tule elk and is unsuitable because of urban development. Individual animals appear healthy and the elk population within the Unit is viable, based on their persistence within the Unit for decades. However, translocation of individual elk into the Unit from other locations could occur in the future, should the need arise.

Summary of Annual Harvests

In 1998, the Fish and Game Commission authorized tule elk hunting under the PLM program for the Connolly Ranch. In 1999, the Connolly Ranch PLM license was expanded to include the adjacent Corral Hollow Ranch (combined, these ranches total

over 11,000 acres). In 2010, the Fish and Game Commission authorized public tule elk hunting within the Unit with a limited quota of one bull tag. However, elk are not accessible to public hunters and there has been no public harvest within the Unit.

Reported harvest for the Unit from 1998-2016 can be found in Table 3. Reported harvest consisted primarily of bulls; the mean annual harvest comprised less than five percent of the reported minimum population size.

PLM program participants within the Unit have not increased since 1999. Continuing the current conservative harvest strategy will have minimal effect on population size as only three antlerless elk have been taken since 2008.

Unit Highlights

While tule elk are well established within the Unit, opportunities for public hunting may remain minimal, except opportunities related to the SHARE program may increase, if warranted. A partial listing of research/monitoring within the Unit includes the following:

Unit Specific Research

Phillips, J.A. 1985. Acclimation of reintroduced tule elk in the Diablo Range, California. Thesis, San Jose State University, California, USA.

Literature Cited:

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

Data Tables/Figures

Table 1. Results of Annual Spring Tule Elk Ground Surveys of the Connolly and Corral Hollow Private Lands Management Area Ranches, San Joaquin County, 1997-2015. Surveys are typically completed in March prior to calving.

Year	Number of Elk Observed				Total
	Bulls	Cows	Calves	Not Classified	
1997	20	47	19	0	**86**
1998	35	32	9	2	**78**
1999	36	52	6	15	**109**
2000	36	73	9	15	**133**
2001	27	110	0	0	**137**
2002	12	71	2	10	**95**
2003	24	68	4	17	**113**
2004	21	92	4	8	**125**
2005	21	71	2	0	**94**
2006	19	88	13	0	**120**
2007	11	54	12	0	**77**
2008	21	45	3	0	**69**
2009	9	53	13	9	**84**
2010	23	73	4	0	**100**
2011	5	50	0	6	**61**
2012	8	25	5	0	**38**
2013	7	33	4	0	**44**
2014	5	34	0	0	**39**
2015	2	35	5	0	**42**

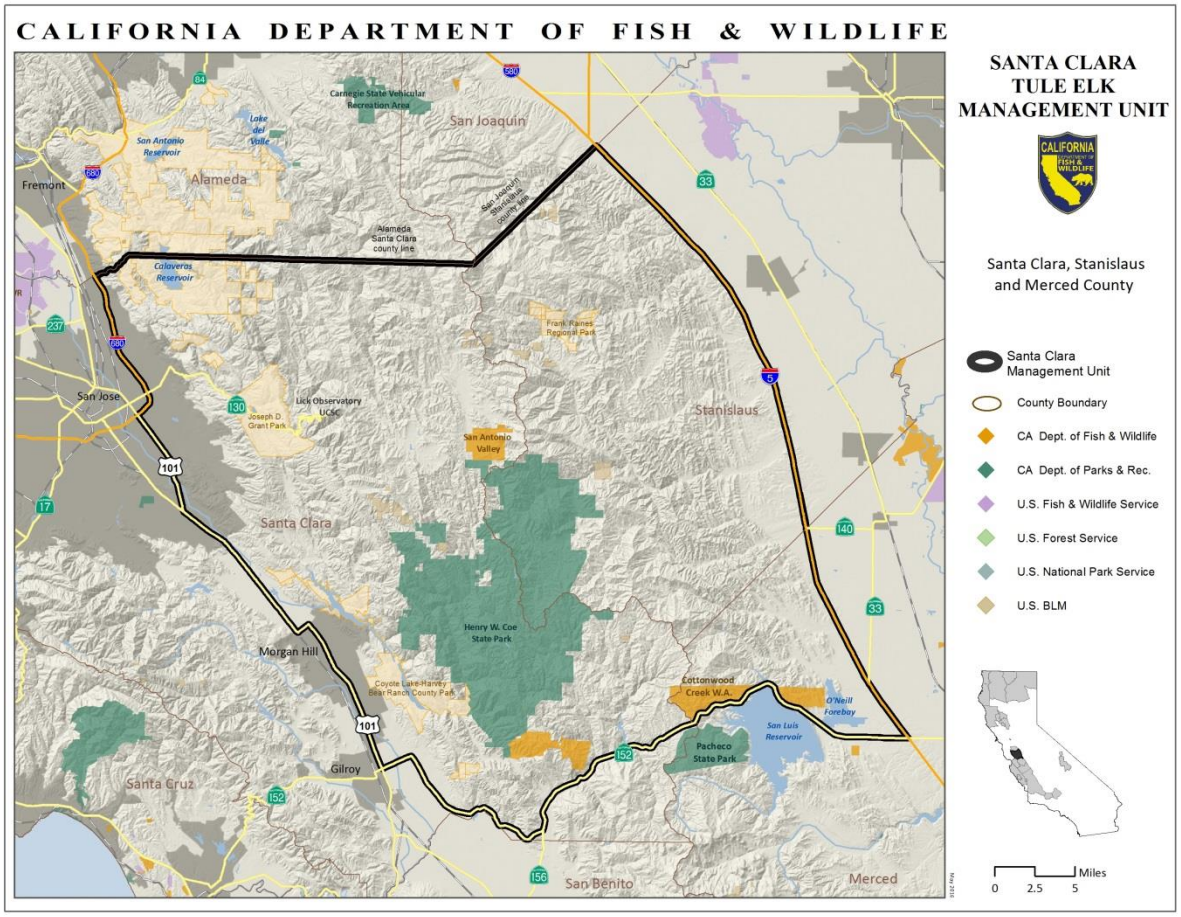
Table 2. Helicopter Survey Results for Alameda and San Joaquin Counties.

Date	Total Elk Counted	Survey Type
2006	58	CDFW Helicopter
2011	80	CDFW Helicopter
2016	66	CDFW Helicopter

Table 3. Alameda–San Joaquin Tule Elk Management Unit, Reported Private Lands Management Area Harvests (1998-2016), and 2010 Public Tag Quotas and Harvests.

Year	Public Bull		Public Antlerless		Reported PLM Harvests		
	Tags Issued	Harvest	Tags Issued	Harvest	Bull Harvest	Antlerless Harvest	Number of Ranches
1998					3	0	1
1999					4	3	1
2000					4	0	1
2001					4	2	1
2002					4	2	1
2003					4	3	1
2004					3	4	1
2005					3	2	1
2006					3	2	1
2007					3	3	1
2008					3	1	1
2009					2	0	1
2010	1	0			2	0	1
2011					2	0	1
2012					2	1	1
2013					2	1	1
2014					0	0	0
2015					1	0	1
2016					1	0	1
Totals	**1**	**0**			**50**	**24**	

Santa Clara/Mount Hamilton Tule Elk Management Unit



Santa Clara/Mount Hamilton
Tule Elk Management Unit

Description

The Santa Clara/Mount Hamilton Tule Elk Management Unit (Unit), formerly known as the Mount Hamilton Tule Elk Management Unit, is located in the Diablo Range, east of San Jose, California. The Unit includes portions of Merced, Santa Clara and Stanislaus counties within the following line: beginning at the intersection of Interstate Highway 5 and the San Joaquin/Stanislaus County line; southeast along Interstate Highway 5 to the intersection of Highway 152; west along Highway 152 to the intersection of Highway 101 near the town of Gilroy; north along Highway 101 to the intersection of Interstate Highway 680 near San Jose; north along Interstate Highway 680 to the intersection of the Alameda/Santa Clara County line; east along the Alameda/Santa Clara County line to the intersection of the San Joaquin, Stanislaus, Alameda, Santa Clara County lines; northeast along the San Joaquin/Stanislaus County line to the point of beginning.

The Unit is within the Bay Delta and Central Coast, and the Central Valley and Sierra Nevada Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015), and historical tule elk (*Cervus canadensis nannodes*) range as depicted by McCullough (1969). Elevation varies from 200 feet on valley floors to over 3,000 feet on surrounding peaks. Topography varies from low gradient valleys to moderately steep terrain. Climate is Mediterranean; temperatures can exceed 100° F in summer and fall below 32° F in winter.

Vegetation includes annual grasslands with a small component of perennial, native grasslands) mixed chaparral, blue oak woodland, blue oak-foothill pine, and valley oak woodlands. Scattered permanent ponds and small reservoirs are found within the Unit. Other features important to elk include fresh emergent wetlands, valley foothill-riparian habitat, and ephemeral and intermittent watercourses, seeps, and springs.

The Unit contains approximately 760,000 acres. Public land within the Unit consists of California Department of Parks and Recreation (CDPR; Henry W. Coe State Park), county parks (Joseph D. Grant County Park), and California Department of Fish and Wildlife (Department; San Antonio Valley Ecological Reserve) properties, but almost 80% is private land used for livestock grazing and recreation. Access generally is limited to landowners and invited guests. Some larger ranches are leased by hunting clubs or participate in the Private Lands Management Program (PLM) program. Recreational activities involving elk include hunting, photography, wildlife viewing, nature study, and shed collecting, but access opportunities are limited. Elk are found on the San Antonio Valley Ecological Reserve and occasionally within Cottonwood Creek Wildlife Area.

Elk Distribution and Abundance

Sixty-five tule elk from the Owens Valley were released on private ranches in southern Santa Clara County near Mt. Hamilton from 1978-1981. These elk dispersed into portions of Alameda, San Joaquin, Santa Clara, and Stanislaus counties. Currently, four distinct subherds exist as follows: Horse Valley, Isabel Valley (both in Santa Clara County), San Antonio Reservoir (Alameda County) and Alameda/San Joaquin (both within the Alameda-San Joaquin management unit). Tule elk have also been released at various locations outside the Unit since 1981 (in south San Benito County, western Merced County and south Monterey County), some of which subsequently dispersed into the Unit. Finally, nine adult bulls from San Luis National Wildlife Refuge were released at the San Antonio Valley Ecological Reserve (Santa Clara County) in March 2014.

The Department does not monitor elk population numbers annually throughout the Unit but has completed periodic helicopter surveys (Table 1). In January 2011, the Isabel Valley Ranch, a PLM program participant, counted 81 elk on their property and the ranch owner reported that 250-300 elk existed in the Unit. The Department believes the population is currently in decline due to five years of drought. All hunting was stopped in 2015 due to decreases in elk numbers. Based on observations and reports from landowners and public agencies, the current population estimate for the Unit is 150 animals.

Management Goals, Objectives, and Actions

The management goals for this Unit are to: 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is currently in decline, primarily due to five years of drought. Population management for this Unit involves efforts to increase elk numbers, where suitable. Regulated public hunting may resume if the elk population increases again. When hunting resumes, it will involve a conservative level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict.

Private land is essential to the survival of tule elk within the Unit, but the potential exists for agricultural/private property conflicts. Public elk hunting opportunities are extremely limited because of access limitations and the lack of public land that supports elk. The population management strategy, once resumed, will utilize hunting through the PLM program to alleviate conflicts and provide landowners an incentive to accommodate the needs of tule elk.

Expanding elk use of private lands where they are tolerated is one method to successfully increase elk populations. Private lands where the presence of elk may be tolerated or encouraged include woodlands, ownerships enrolled in the PLM program, and other properties where elk are desired by the landowner. Where suitable unoccupied elk habitat exists, management actions should facilitate natural dispersal to reestablish elk.

Enhancing elk habitat, such as early seral vegetation, is critical to increasing elk populations. Natural disturbance, such as fire, promotes a mix of habitat types and successional stages including forest openings that benefit elk. Enhancing early seral habitats through fire or habitat improvement projects is necessary to enhance elk populations. To achieve these objectives, the Department will collaborate with state and local agencies and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue helicopter surveys (augmented, as necessary, with ground surveys conducted in cooperation with local landowners). Surveys should occur on a three-year rotation. Ongoing.

Action 1.1.2
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to determine population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 15% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and grazing techniques to benefit elk. Ongoing.

Action 1.2.3
Work with land agencies, PLM operators, and other private landowners to develop/improve water sources and calving cover (particularly in riparian areas), remove potential lethal hazards (e.g., old fencing), and install fence crossing structures. Expected completion: 2022.

Action 1.2.4
Maintain or improve existing fence boundaries for public land (e.g., Henry Coe State Park and San Antonio Valley Ecological Reserve) to prevent cattle trespass onto public land. Expected completion: 2020.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with CDPR, California Department of Forestry and Fire Protection, NGOs, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and local agencies, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Work with PLM operators and other private landowners to improve forage conditions by planting grasses/forbs (compatible with sensitive plants) and providing mineral supplements. Ongoing.

Action 1.3.5
Collaborate with academia to collect habitat use data to identify areas utilized by elk and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.6
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.7
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2023.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2021.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters (once hunting is resumed) for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 150-250 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 2.1. Maintain elk hunting opportunities where compatible with population objectives.

Action 2.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 2.1.2
Utilize SHARE to provide elk hunting opportunities and address human-elk conflicts on private property (once population levels improve). Ongoing.

Objective 2.2. Work with other agencies and NGOs to install an elk interpretive sign by 2024.

Action 2.2.1
Evaluate the feasibility of an elk interpretive/research program at San Antonio Valley Ecological Reserve. Deadline for initiation: 2021.

Objective 2.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

Human-elk conflicts have been minimal, with only periodic complaints involving competition with livestock for forage and fence damage. If the elk population approaches the maximum objective, actions to control population numbers may be necessary. The PLM program has provided an incentive for participants to modify livestock grazing and otherwise accommodate elk within the Unit. Additionally, elk fence-crossing structures can be installed in areas where fence damage is attributed to elk.

If elk distribution expands or population numbers increase, damage and agricultural conflicts could escalate. Controlling population numbers and damage/land use conflicts with regulated hunting may become more challenging because of the prevalence of private land within the Unit. The SHARE program is a potential population management strategy that can improve public access to private (or landlocked public) land. The SHARE program may also assist in controlling elk population numbers and managing damage/land use conflicts that involve elk on private land.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program currently is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may

improve tolerance of elk on their properties. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when identifiable animals cause property damage.

Objective 3.1. Continue to monitor human-elk conflicts on private property.

Action 3.1.1
Map areas of human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Tule elk have been reestablished within the Unit for over 30 years. The Unit is adjacent to the Alameda-San Joaquin unit to the north and the San Luis Reservoir/Western Merced unit to the south. Natural interchange of individuals between these units may

occur. Individuals and small groups of elk (and their progeny) from releases at various sites in San Benito, Merced, and Monterey counties since 1981 may have dispersed into the Unit. Cumulatively, these factors contribute to genetic diversity and long-term viability of the Santa Clara/Mt. Hamilton herd. Finally, periodic translocation of individual elk into the Unit from other locations should continue opportunistically in the future.

If livestock grazing does not increase and PLM tag quotas remain unchanged, the elk population is expected to increase. Herd upper limit levels ultimately may be determined based on rangeland condition indices (e.g., residual dry matter calculations, plant height, species composition and density). However, the majority of tule elk in the Unit inhabit private land and upper limits may be influenced by landowner tolerance for elk and/or a qualitative assessment of rangeland conditions by private landowners.

Summary of Annual Harvests

In 2001, the Fish and Game Commission (FGC) authorized the Isabel Valley Ranch to hunt tule elk under the PLM program. Additional ranches (Mallison Ranch, Sweetwater Hunting Club, Slick Rock Hunting Club, and Rooster Comb Ranch) within the Unit subsequently joined the PLM program. Combined, these five ranches total over 19,000 acres. Currently one ranch is enrolled in the PLM program.

In 2010, the FGC authorized public tule elk hunting within the Unit (with a limited quota of one bull tag). Table 2 contains reported harvests for the Unit from 2001-2016.

Figure 1 contains the average (mean) age of antlered (bulls) and antlerless elk taken within the Unit since 2002. Annual sample sizes are small and in some years, samples were not collected. Harvested bulls ranged from 2.0-7.0 years old, whereas antlerless elk ranged from 7.5-11.0 years old.

Unit Highlights

Cooperation and support of private landowners is critical to maintaining the Santa Clara/Mount Hamilton herd. Collaboration with private landowners (particularly PLM program participants) will be important for this herd to thrive on a long-term basis. The Department has collaborated with private landowners and the academic community to develop plans and programs to manage tule elk. Below is a partial listing of management activities undertaken and accomplishments within the Unit:

- Fowler (1985) reviewed the status of tule elk in California, including those within the Santa Clara/Mount Hamilton Unit.

- Phillips et al. (1982) and Phillips (1985) monitored elk re-introduced to the Unit.

A partial listing of products from these and other studies submitted to the Department includes the following:

Unit Specific Research

Fowler, G.S. 1985. Tule elk in California: history, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California, Berkeley, USA.

Phillips, J.A. 1985. Acclimation of reintroduced tule elk in the Diablo Range, California. Thesis, San Jose State University, California, USA.

Phillips, J.A., M.J. Kutilek and G.L. Shreve. 1982. Habitat utilization and acclimation of introduced tule elk (*Cervus elaphus nannodes*) in the Central Diablo Range of California. Pages 54-56 *in* Proceedings of the Western States Elk Workshop, 22-24 February 1982, Flagstaff, Arizona, USA.

Literature Cited:

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press. Berkeley, USA.

Data Tables/Figures

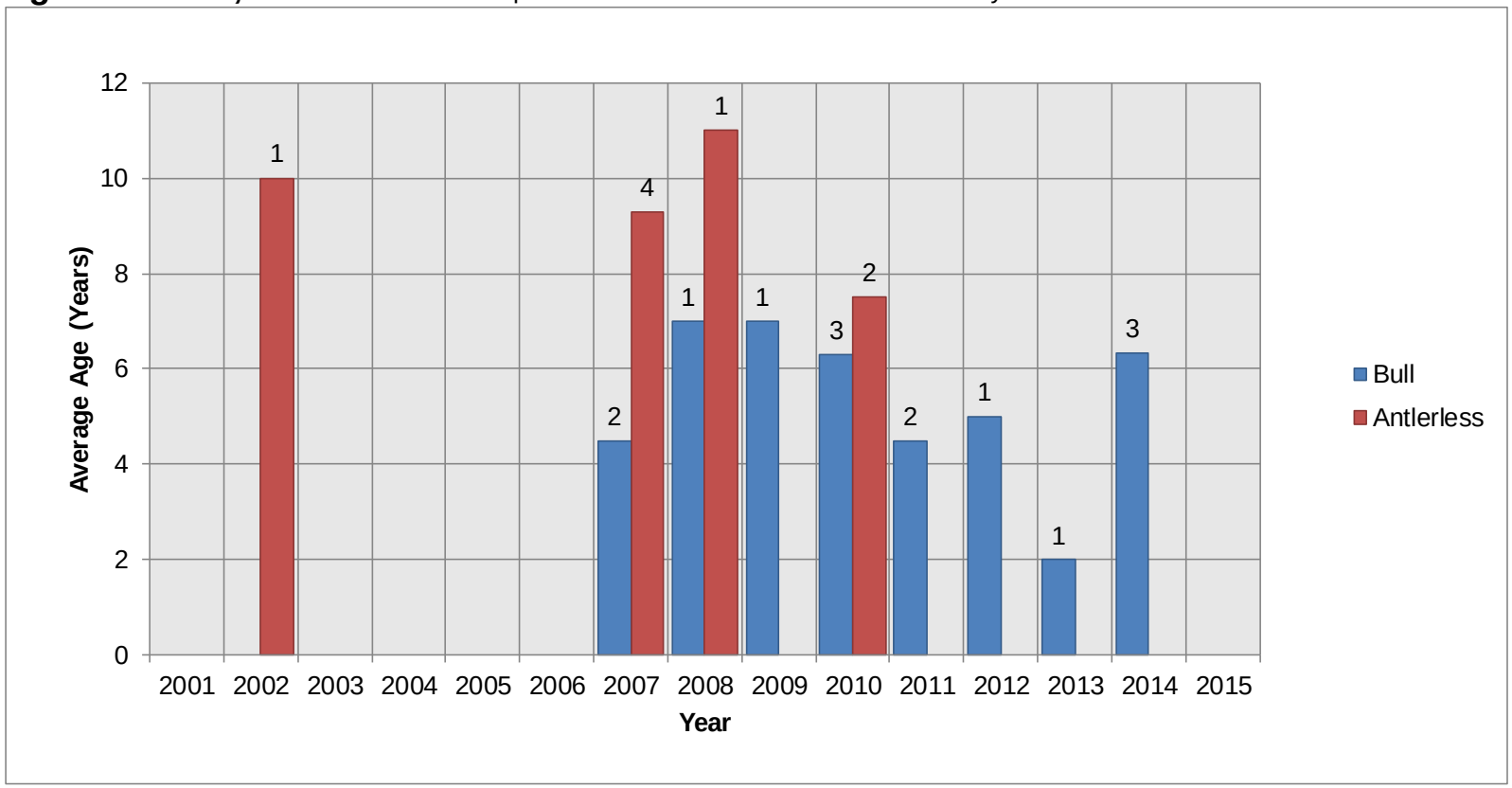
Table 1. Santa Clara/Mount Hamilton Helicopter Elk Surveys.

Year	Bulls	Cows	Calves	Unclassified	Total
2006	12	68	25		105
2007	14	53	20		87
2011	7	56	7	3	73
2016	2	58	3	3	63

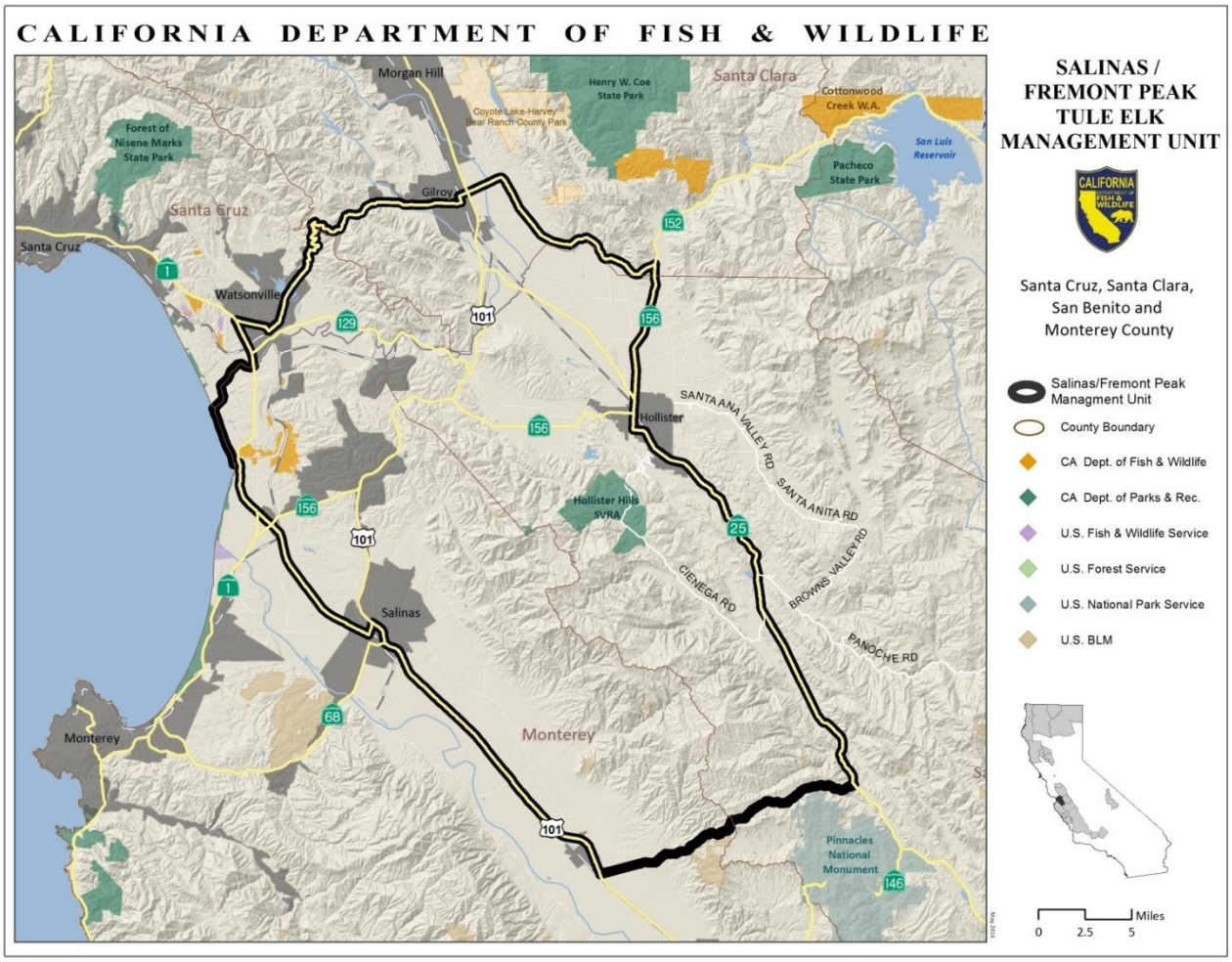
Table 2. Santa Clara Tule Elk Management Unit, Reported Private Lands Management Area Harvests, and Public Tag Quotas and Harvests, 2010-2016.

	Public Bull		Public Antlerless		Reported PLM Harvest		
Year	Tags Issued	Harvest	Tags Issued	Harvest	Bull Harvest	Antlerless Harvest	Number of Ranches
2001					3	6	1
2002					3	6	1
2003					3	6	1
2004					5	7	2
2005					6	9	1
2006					7	9	3
2007					9	11	5
2008					5	4	5
2009					6	6	5
2010	1	1			7	5	5
2011	1	1			7	3	5
2012	1	1			5	3	5
2013	1	1			5	2	5
2014	1	1			3	0	4
2015					0	0	1
2016					0	0	1
Totals	**5**	**5**	**0**	**0**	**74**	**77**	
Success Rate	**100%**						

Figure 1. Average Age of Harvested Elk within the Santa Clara/ Mount Hamilton Tule Elk Management Unit, 2002 - 2015. Sample sizes are denoted above bars for each year.



Salinas/Fremont Peak Tule Elk Management Unit



Salinas/Fremont Peak
Tule Elk Management Unit

Description

The Salinas/Fremont Peak Tule Elk Management Unit (Unit), formerly referred to as the Fremont Peak Tule Elk Management Unit, includes portions of Monterey and San Benito counties east of Salinas. The Unit is bounded on the south by Chualar Canyon Road, on the east by the Reeves Ranch, and on the west by Old Stage Road. The City of Salinas is growing and encroaching on the western boundary of the Unit.

The Unit is within the Bay Delta and Central Coast Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015), and historical tule elk (*Cervus canadensis nannodes*) range as depicted by McCullough (1969). It includes the northern portion of the Gabilan Range, where vegetation consists of rolling oak woodlands and grasslands. Coastal chaparral occurs on mid-elevation slopes, and open pine forests occur at the highest elevations. Elk inhabit elevations that vary from 700 to 1,200 feet. Climate is Mediterranean; temperatures exceed 100° F in summer and fall below 32° F in winter. Average annual precipitation in Salinas is 13 inches, most of which occurs from October through April.

The vast majority of the Unit is privately owned and used for livestock and agricultural crop production, hunt clubs, and fuel-wood harvest. Public land includes Fremont Peak State Park at the northern edge of the Unit. Fenced Cattle ranches surround this park, which is therefore seldom, if ever, used by elk. Recreational activities involving elk include hunting, photography, wildlife viewing, nature study, and shed collecting. Elk are occasionally seen by the public from Old Stage Road. Four private ranches offer elk hunting opportunities through the Private Lands Management (PLM) program. Apart from the PLM program, public access for elk-related recreational activities is extremely limited.

Elk Distribution and Abundance

In November, 1983 the California Department of Fish and Wildlife (Department) relocated 20 elk from the Tupman Tule Elk State Reserve in Kern County to the Reeves Ranch near Fremont Peak in Monterey County, thereby establishing the Salinas/Fremont Peak herd. Four elk were fitted with radio transmitters and monitored for 16 months by a student from California Polytechnic State University, San Luis Obispo. In February 1984, the herd moved west from the Reeves Ranch to the Gabilan (Silacci) Ranch, and became established in an area generally centered on Dunn Canyon and Alisal Creek. The Reeves, Silacci, and Bardin ranches are all in close proximity to each other and the Fremont Peak State Park.

The Department has documented non-hunting mortalities from predation and poaching within the Unit. Although these factors are unquantified, they have not limited elk population growth. Results of ground and helicopter surveys performed by Department personnel, contractors, and private landowners, of elk in the Unit can be found in Table 1. The surveys were not standardized, and varied in timing, duration, observer experience, and geographic area covered. Despite these limitations, surveys indicate the current population estimate for the Unit is 225 animals and has increased almost tenfold since 1983.

Management Goals, Objectives, and Actions

The management goals for this Unit are to: 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The Department considers the elk population to be increasing. Population management for this Unit includes efforts to increase elk numbers where suitable, while working to reduce or stabilize numbers in conflict areas. Private land is essential to the survival of tule elk within the Unit, but the potential exists for agricultural/private property conflicts. The current population management strategy utilizes hunting through the PLM program to alleviate conflicts and provide landowners an incentive to accommodate the needs of tule elk. Where suitable, unoccupied elk habitat exists, management actions should facilitate natural dispersal to reestablish elk where conflicts will be minimal. Expanding elk use of private lands where they are tolerated is one method to successfully increase elk populations. Such private lands include timberlands, ownerships enrolled in the PLM program, and other properties where landowners desire elk.

Prescribed burning has been especially important within this Unit. Continuing the prescribed burning program will be challenging because conflicts have developed over air quality and smoke management. Salinas's growth exacerbates these conflicts. PLM operators are working to develop smoke management plans which may restore some flexibility to using prescribed fire management activities.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings, that benefit elk. To achieve these objectives, the Department will collaborate with state and local agencies, and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2024, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue helicopter surveys (augmented, as necessary, with ground surveys conducted in cooperation with local landowners). Surveys should occur on a three-year rotation. Ongoing.

Action 1.1.2
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2024.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle (UAV) surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and grazing techniques to benefit elk. Ongoing.

Action 1.2.3
Work with land agencies, PLM operators, and other private landowners to develop or improve water sources and calving cover particularly in riparian areas, remove potential lethal hazards (e.g., old fencing), and install fence crossing structures. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with local agencies, California Department of Transportation, NGOs, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and local agencies, and private landowners to identify specific areas for prescribed burns that benefit elk. Ongoing.

Action 1.3.4
Work with PLM operators and other private landowners to improve forage conditions by planting grasses/forbs (compatible with sensitive plants), reducing juniper encroachment, and providing mineral supplements. Ongoing.

Action 1.3.5
Collaborate with academia to collect habitat use data to identify areas utilized by elk and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.6
Participate in landscape-level planning efforts, to the extent possible, to identify potential impacts and make recommendations to benefit elk and elk habitat. Ongoing.

Action 1.3.7
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2024.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2022.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 150-250 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags),

quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 2.1. Increase elk hunting opportunities by at least 10% by 2023, where feasible and compatible with population objectives.

Action 2.1.1
Evaluate the feasibility of establishing a public elk hunt within the Unit. Expected completion: 2020.

Action 2.1.2
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 2.1.3
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Expected completion: 2020.

Objective 2.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

To date, human-elk conflicts have been minimal, with periodic complaints involving competition with livestock, and fence damage. If the elk population approaches the maximum objective, additional actions to control population numbers may become necessary. The PLM program has provided an incentive for participants to modify livestock grazing, and otherwise accommodate elk within the Unit. Additionally, elk fence-crossing structures can be installed in areas where fence damage is attributed to elk.

If elk distribution expands or population numbers increase, damage and agricultural conflicts could escalate. Controlling population numbers and damage/land use conflicts with regulated hunting may become more challenging because of the prevalence of private land within the Unit. The SHARE program is a potential population management strategy that can improve public access to private or landlocked public land, assist in controlling elk population numbers, and managing damage/land use conflicts that involve elk on private land.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program, currently, is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve their tolerance of elk. Through PLM and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

Tolerance for elk in agricultural fields near Salinas, in the vicinity of Old Stage Road to the north and west of the Unit, has declined with the detection of E-coli bacteria in bagged spinach around 2008. This led to serious human illnesses and challenged the agricultural community to produce uncontaminated crops from open fields. In response, the industry drafted a “leafy greens accord” to protect against contaminated produce. The accord contained measures to keep wildlife, birds, and domestic stock out of agricultural fields particularly in row crops such as lettuce, spinach, strawberries, broccoli, and cauliflower.

Objective 3.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 3.1.1
Map areas of human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

The Salinas/Fremont Peak herd is healthy and has persisted for over 30 years. The herd is viable, but is relatively isolated from other management units and might benefit from periodic translocation of individual elk into the Unit on an opportunistic basis. Based on recent surveys (Table 1), the Salinas/Fremont Peak herd may soon be approaching its current upper limit. During recent summers, a group of about ten cows and calves was seen west of Old Stage Road and damage/conflicts have occurred. Human tolerance for elk in the Unit may decline if these conflicts escalate in residential or agricultural areas.

Summary of Annual Harvests

The Fish and Game Commission first authorized annual hunting under the PLM program within the Salinas/Fremont Peak Unit in 1990. PLM tags currently are designated as antlerless tags or bull tags to allow the harvest to be stratified by sex. Four ranches, with a collective total of over 23,000 acres, have hunted tule elk under the PLM program (Table 2). Until recently, PLM participants were reluctant to harvest antlerless elk. Reported harvests have varied but average approximately two bulls and one antlerless elk per year.

The mean age of antlered (bulls) and antlerless elk taken within the Unit since 1990 are summarized in Figure 1. Sample sizes are small and teeth were not collected each year, making it difficult to identify an age trend based on this information.

Unit Highlights

Cooperation and support of private landowners is essential in maintaining the Salinas/Fremont Peak herd. While habitat conditions are good, collaboration with private landowners, particularly those participating in the PLM program, will be important for this herd to continue to thrive. The Department has collaborated with private landowners and the academic community to develop plans and programs to manage tule elk. Below is a partial listing of these activities:

- In 1988, the Department prepared the Fremont Peak Tule Elk Management Unit Management Plan.
- Fowler (1985) reviewed the status of tule elk in California, including that of the Fremont Peak Tule Elk Herd.
- Hanson and Nelson (1984) prepared a report on the re-introduction of tule elk to the Reeves Ranch (Monterey County).

A partial listing of these and other studies submitted to the Department includes the following:

Unit Specific Research

California Department of Fish and Game. 1988. Fremont Peak tule elk management unit management plan. Unpublished report, California Department of Fish and Game, Sacramento, USA.

Fowler, G.S. 1985. Tule elk in California: history, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California, Berkeley, USA.

Hanson, M.T., and S.L. Nelson. 1984. Progress report for introduction of tule elk onto private ranch lands – Reeves Ranch. Unpublished project report, California Polytechnic State University, San Luis Obispo, USA.

Literature Cited:

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Data Tables/Figures

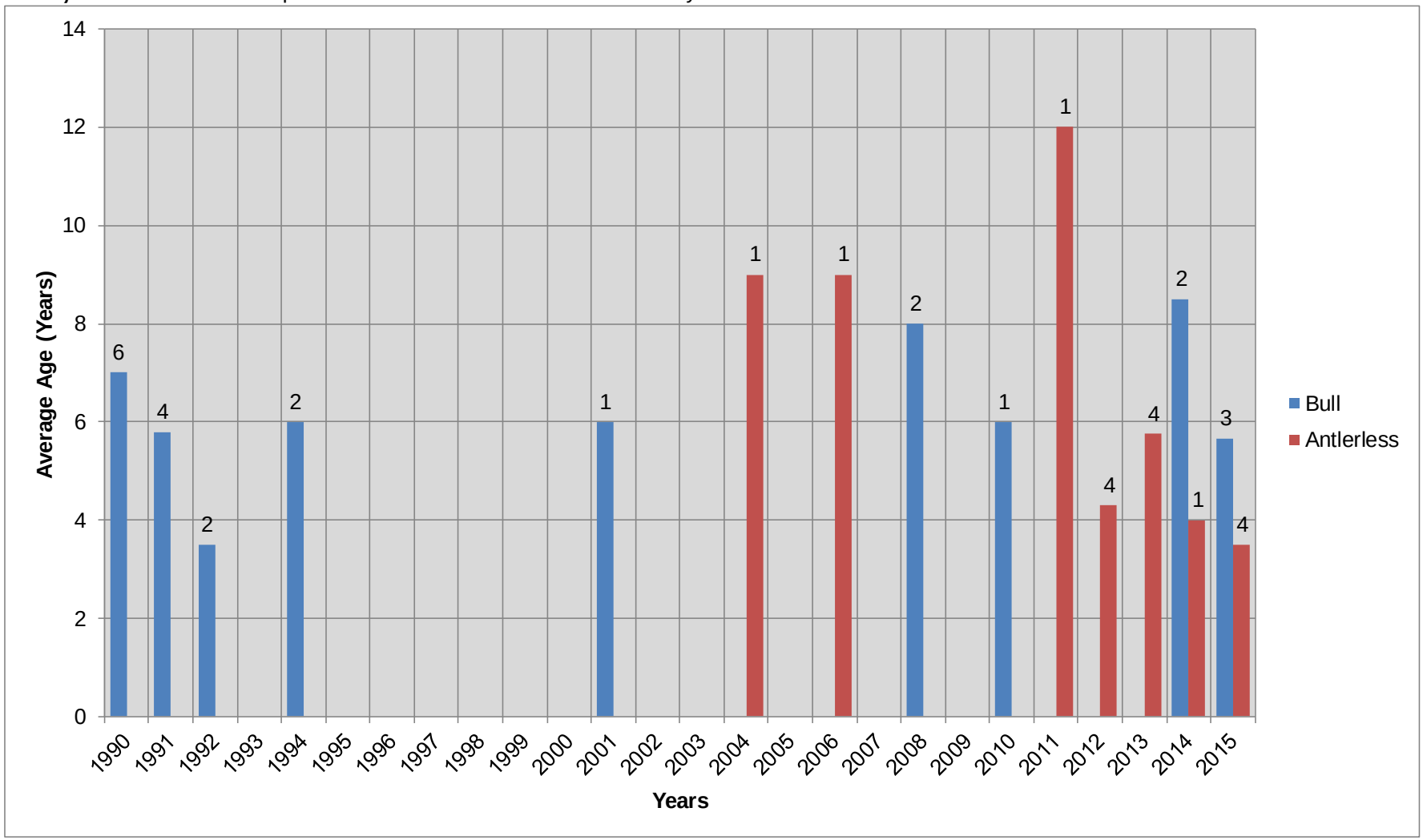
Table 1. Tule Elk Surveys for the Salinas/Fremont Peak Tule Elk Management Unit.

Year	Number of Elk Observed					Notes
	Bulls	Cows	Calves	Not Classified	Total	
1983	5	10	5	0	**20**	Source: 1988 Fremont Peak Unit Management Plan. Survey method unknown.
1984	4	11	4	0	**19**	Source: 1988 Fremont Peak Unit Management Plan. Survey method unknown.
1985	6	12	7	0	**26**	Source: 1988 Fremont Peak Unit Management Plan. Survey method unknown.
1986	11	12	5	0	**28**	Source: 1988 Fremont Peak Unit Management Plan. Survey method unknown.
1987	12	14	6	0	**32**	Source: 1988 Fremont Peak Unit Management Plan. Survey method unknown.
1988	16	15	10	0	**41**	Source: 1988 Fremont Peak Unit Management Plan. Survey method unknown.
1989	20	17	5	0	**42**	Source: Gabilan Ranch 1992 Annual Report. Observed numbers reconstructed from counts/ratios reported by landowner.
1990	22	17	7	0	**46**	Source: Gabilan Ranch 1992 Annual Report. Observed numbers reconstructed from counts/ratios reported by landowner.
1991	22	19	10	0	**51**	Source: Gabilan Ranch 1992 Annual Report. Observed numbers reconstructed from counts/ratios reported by landowner.
1992	27	25	12	0	**64**	Source: Gabilan Ranch 1995 Annual Report. Observed numbers reconstructed from counts/ratios reported by landowner.
1993	25	26	10	0	**61**	Source: Gabilan Ranch 1995 Annual Report. Observed numbers reconstructed from counts/ratios reported by landowner.
1994	18	31	17	0	**66**	Source: 1995 Annual Report, Gabilan Ranch PLM.
1995	26	39	7	0	**72**	Source: 1996 Annual Report, Gabilan Ranch PLM.
1996	29	43	18	0	**90**	Source: 1997 Annual Report, Gabilan Ranch PLM.
1997	28	58	14	0	**100**	Source: 1997 Annual Report, Gabilan Ranch PLM.
1998	35	63	26	0	**118**	Source: 1999 Silacci (Gabilan) Ranch Management Plan. Observed numbers reconstructed from counts/ratios reported by landowner.
2001	22	80	0	0	**102**	Source: CDFW files. Helicopter Survey.
2004	48	123	27	0	**198**	Source: CDFW files. Helicopter Survey.
2006	50	115	26	0	**191**	Source: CDFW files. Helicopter Survey.
2007	42	101	13	0	**156**	Source: CDFW files. Helicopter Survey.
2008				150	**150**	Source: Gabilan Ranch count
2015	47	150	0	0	**197**	Source: Bardin Ranch count
2016	37	180	7	0	**224**	Source: CDFW files. Helicopter Survey.

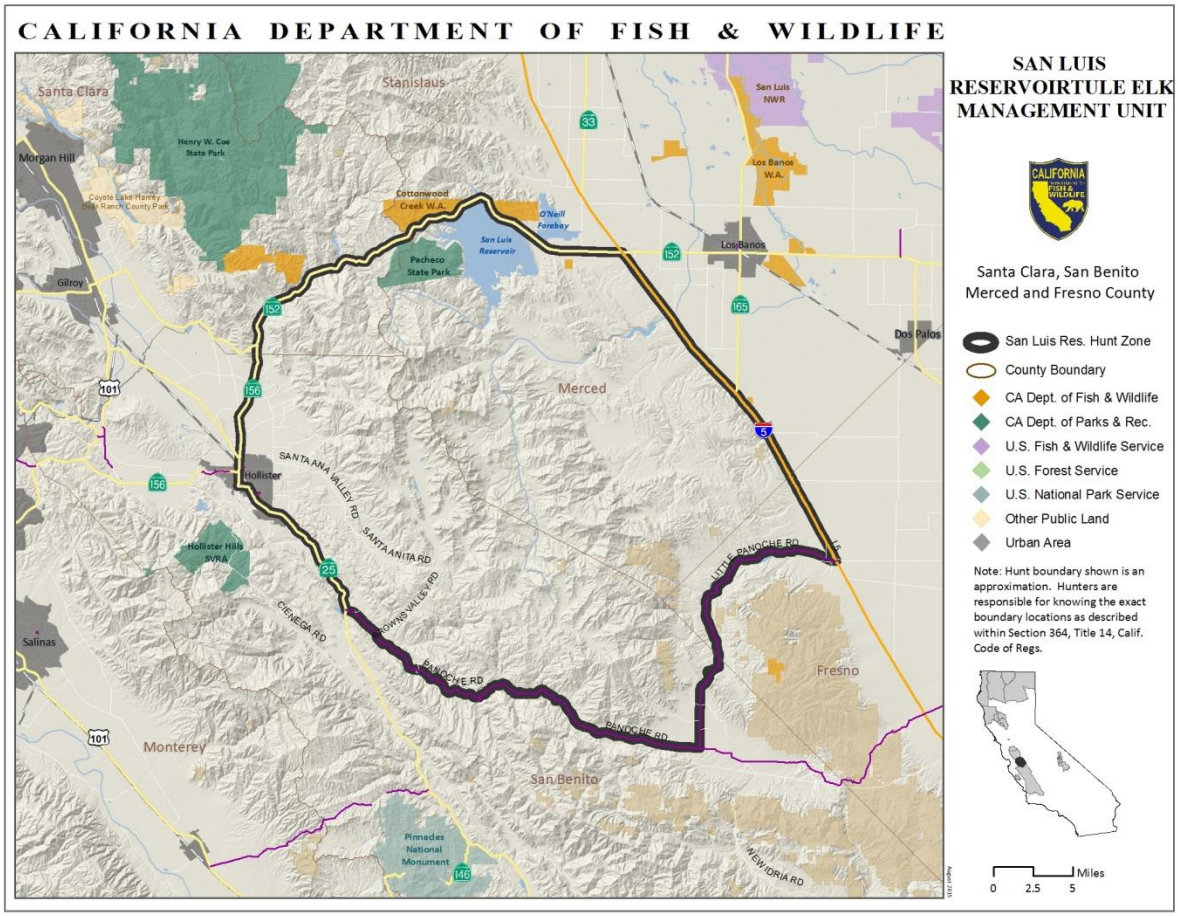
Table 2. Salinas/Fremont Peak Tule Elk Management Unit, Reported Private Lands Management Area Harvests, 1990-2016.

Reported PLM Harvest			
Year	**Bull Harvest**	**Antlerless Harvest**	**Number of Ranches**
1990	6	0	1
1991	4	0	1
1992	6	0	2
1993	3	0	2
1994	4	0	2
1995	1	0	2
1996	0	0	2
1997	2	0	2
1998	0	0	2
1999	3	0	2
2000	2	0	2
2001	2	0	2
2002	2	0	2
2003	5	1	2
2004	2	1	2
2005	2	0	2
2006	2	1	2
2007	0	0	2
2008	3	1	2
2009	2	6	4
2010	2	4	3
2011	2	8	4
2012	5	8	4
2013	5	8	4
2015	5	8	4
2016	5	8	4
Totals	**75**	**54**	

Figure 1. Average Age of Harvested Elk within the Salinas/Fremont Peak Tule Elk Management Unit, 1990-2015. Sample sizes are denoted above bars for each year.



San Luis Reservoir/Western Merced Tule Elk Management Unit



San Luis Reservoir/Western Merced Tule Elk Management Unit

Description

The San Luis Reservoir/Western Merced Tule Elk Management Unit (Unit), formerly called the Western Merced Tule Elk Herd, includes portions of Merced, Fresno, San Benito, and Santa Clara counties. Specific boundaries are: within a line beginning in Merced County at the junction of Highway 152 and Interstate Highway 5 near the town of Santa Nella, west along Highway 152 to Highway 156 in Santa Clara County, southwest along Highway 156 to Highway 25 near the town of Hollister in San Benito County, south along Highway 25 to the town of Paicine, south and east along J1 to Little Panoche Road, North and east along Little Panoche Road to Interstate Highway 5 in Fresno County, north along Interstate Highway 5 to the point of beginning.

The Unit is within historical tule elk (*Cervus canadensis nannodes*) range, as depicted by McCullough (1969), and is within the Bay Delta and Central Coast, and the Central Valley and Sierra Nevada Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). Vegetation consists of chaparral, woodland-grassland, woodland-chaparral, and grassland habitats. Elevations range from 250 to 4,000 feet. Precipitation typically averages 10 to15 inches per year, with less rainfall in the southern portion of the Unit, and higher in the north-central portion. Temperatures may exceed 100° F in summer and decline below freezing in winter.

The Unit contains approximately 500,000 acres, of which over 90% is privately owned and used primarily for livestock grazing. A secondary private land use involves hunting deer and other game species by organized clubs. Public lands include California Department of Parks and Recreation property (CDPR) including 6,800 acres in Pacheco State Park and approximately 25,000 acres in the San Luis Reservoir State Recreation Area, both of which are closed to elk hunting. One public area, the 900-acre California Department of Fish and Wildlife (Department) San Luis Reservoir Wildlife Area, is open to elk hunting using archery equipment only. Elk use of public land in the Unit is limited, as are public elk hunting opportunities.

Primary recreational activities involving elk include wildlife viewing and photography. Elk are regularly observed from Highway 152 and Basalt Road. Public users of the San Luis Reservoir Recreation Area and Pacheco State Park regularly comment on the benefit to their experience from observing elk. Elk can also be seen within the San Luis Reservoir Wildlife Area, and from other public roads and trails within the Unit. Hunting and shed collecting is reported to occur on private lands.

Elk Distribution and Abundance

Twenty-one elk from Concord Naval Weapons Station were released on a private ranch south of the San Luis Reservoir to reestablish tule elk in the Unit in 1990. Elk dispersed widely from the release site (Bureau of Land Management 1992). In 1992, eight additional cows and one bull from Grizzly Island were added and, in 1998, nine more cows and one bull from Tupman Tule Elk State Reserve in Kern County were added.

Currently, elk are distributed in a general area bounded by Highway 152 on the north, Interstate Highway 5 on the east, the Merced-San Benito County line on the west and Arburua Flats on the south. Based on previous observation of mostly unmarked elk, there are at least two subherds within the Unit. The first contains descendants of elk from the Tupman release, which inhabit lower elevation areas below San Luis Reservoir. This subherd is often in one large group with several satellite bull groups. Some seasonal movement occurs with elk using the agricultural interface during the calving and dry season. The second subherd uses areas west and south of San Luis Reservoir and may be composed of descendants from the Concord release. This subherd contains multiple cow groups and satellite bulls. Solitary individuals are often observed and the level of exchange between the two subherds is unknown. Elk also have been observed on private property several miles south of San Luis Reservoir, and their numbers are increasing in that area. Beginning in 2015, the Department placed GPS radio collars on elk to assess distribution, movement patterns, and home ranges.

The Department has conducted annual fixed-wing aircraft surveys since 2001 to monitor the tule elk population within the Unit (Table 1). In 2008, the Department performed a helicopter survey, followed by a fixed wing survey to assess differences in observation rates between aircraft types. Total numbers observed using both methods were similar. The current population estimate for the Unit is 350 animals.

Management Goals, Objectives, and Actions

The management goals for the Unit are to: 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is increasing and has not reached the upper population identified in Objective 1.6. Population management for this Unit involves efforts to increase elk

numbers where suitable, while working to reduce or stabilize elk numbers in conflict areas. It will involve a conservative level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict, and focused elk hunting and depredation relief in areas where reoccurring conflicts develop.

The current population management strategy provides limited public and Private Lands Management (PLM) hunting opportunities at levels that should result in continued elk population growth. Elk hunting is prohibited within the San Luis Reservoir State Recreation Area, and their use of this area has been limited. If elk use increases, then the Department may coordinate with State Parks to request access for elk hunting.

Private land is important to the survival of tule elk within the Unit. Elk heavily utilize these private lands, which in some areas causes conflict with landowners. Expanding elk use of private lands where they are tolerated or desired, is one method to successfully increase the elk population. Management actions should facilitate natural dispersal to reestablish elk where conflicts will be minimal.

The fallow deer louse (*Bovicola tibialis)* has been found on deer near San Luis Reservoir. It is possible this louse could infect elk, and the impacts are not known. In 2013-2014, the Department captured and examined elk for the presence of louse with no positive findings.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with state and local agencies, and private landowners.

Objective 1.1. Continue and complete projects to estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue helicopter surveys (augmented as necessary with ground surveys conducted in cooperation with local landowners). Surveys should occur on a three-year rotation. Ongoing.

Action 1.1.2
Continue to affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and grazing techniques to benefit elk. Ongoing.

Action 1.2.3
Work with land agencies, PLM operators, and other private landowners to develop/improve water sources and calving cover (particularly in riparian areas), remove potential lethal hazards (e.g., old fencing), and install fence crossing structures. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with CDPR, California Department of Forestry and Fire Protection, NGOs, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and local agencies, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Work with PLM operators and other private landowners to improve forage conditions by planting grasses/forbs compatible with sensitive plants and providing mineral supplements. Ongoing.

Action 1.3.5
Collaborate with academia to collect habitat use data to identify areas utilized by elk and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.6
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.7
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2023.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2021.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Determine if exotic lice are present on tule elk by 2023.

Action 1.6.1
Collaborate with CDPR and private landowners on examining elk for the presence of exotic lice. Ongoing.

Objective 1.7. Maintain a population of 300-500 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.7.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.72
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 2.1. Increase elk hunting opportunities by at least 10% by 2023, where feasible and compatible with population objectives.

Action 2.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 2.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Objective 2.2. Install an elk interpretive sign by 2023.

Action 2.2.1
Meet with CDPR to evaluate the possibility of adding an elk interpretive sign. Expected completion: 2021.

Objective 2.3. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.3.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

Human-elk conflicts have been minimal in this Unit, confined to periodic complaints involving competition with livestock, and fence damage. If the elk population approaches the maximum objective, actions to control population numbers may become necessary. The PLM program has provided an incentive for participants to modify livestock grazing, and otherwise accommodate elk within the Unit. Additionally, private landowners can install fence-crossing structures for elk.

In the northern portion of the Unit, vehicle collisions may occur along Highway 152. This will likely exacerbate as the elk population increases. Improved habitat conditions on a portion of the Pacheco State Park could encourage elk dispersal west of San Luis Reservoir, into the hills immediately south of Highway 152. Suitable habitat exists to the north of Highway 152 and there is a possibility of vehicle collisions as elk attempt to cross the highway.

The proposed high-speed rail project is a concern and may limit elk movement depending on route selection. In addition, a large development is proposed near San Luis Reservoir between summer and winter use areas. This could increase the potential for vehicle collisions, restrict movement between use areas, and contribute to human-elk conflicts.

If elk distribution expands or population numbers increase, damage and agricultural conflicts could escalate. Controlling population numbers and damage/land use conflicts with regulated hunting may become more challenging because of the prevalence of private land within the Unit. The SHARE program is a potential population management strategy that can improve public access to private (or landlocked public) land. The SHARE program may also assist in controlling elk population numbers and managing damage/land use conflicts that involve elk on private land.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program, currently, is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve tolerance of elk on their properties. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when identifiable animals cause property damage.

Objective 3.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 3.1.1
Map areas of human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Continue to review the potential impacts from large-scale projects, such as high-speed rail and other developments, and provide input and mitigation measures. Ongoing.

Action 3.1.5
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.6
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

The San Luis Reservoir/Western Merced tule elk herd has been established for more than 20 years and is healthy. The population has grown and is expected to continue increasing. Suitable, unoccupied habitat exists adjacent to areas that contain elk and the Department expects the population will expand into these adjacent areas as it increases.

Competition with livestock grazing is or may become a factor that limits elk use of suitable habitat within the Unit. Pacheco State Park provides grazing on part of the property. Reducing livestock grazing on public land may help elk extend their range into additional areas of the park. Grazing management could also direct dispersal to the west, away from Highway 152.

The Unit is adjacent to the Santa Clara and Hernandez Reservoir/South San Benito elk management units, but connectivity with them is unknown. These units could benefit from periodic and opportunistic translocation of elk.

In the future, elk could disperse south of the Los Banos Creek drainage and enhance population viability throughout the Unit. Several landowners in this area desire elk on their property for hunting purposes, which could result in expanded elk populations and additional hunter opportunities with PLM, SHARE, and public tags.

Private land is essential to the survival of tule elk within the Unit, but the potential exists for agricultural/private property conflicts. Much of the Unit's land is managed as rangeland for cattle. Livestock grazing may be an important factor that influences elk distribution and habitat. While elk can be distributed over a large area, they may avoid areas intensively grazed by livestock in favor of specific areas with no or very limited

livestock grazing. Future research should focus on identifying desired habitat conditions for key areas such as elk calving grounds, and determining how these areas may be impacted by livestock grazing. For those landowners that want to have elk on their land, management activities that are mutually beneficial should be identified to provide landowners incentives to accommodate/tolerate elk, provide public opportunities to use/enjoy elk, and improve herd viability.

Summary of Annual Harvests

The Fish and Game Commission first authorized public elk hunting within the Unit in 2007. Initially, two either-sex tags were available. In 2008, the quota was increased to three and in 2015, increased to five (Table 2). Public tag quotas have been conservative to avoid crowding public hunters on the very limited public land available for elk hunting. Low quotas also helped the Department to determine whether private landowners were receptive to allowing access within the Unit for elk hunting.

In 2007, the DeFrancisco/Eaton Ranch became licensed under the PLM program to hunt elk (Table 2) and two additional properties have expressed interest in the PLM program. Annual harvests (public and PLM combined) are less than three percent of minimum observed herd size, and primarily consist of bulls.

The mean age of antlered (bulls) and antlerless elk taken within the Unit since 2007 are summarized in Figure 1. Sample sizes are small making it difficult to identify an age trend based on this information.

Unit Highlights

During initial releases to reestablish tule elk in the Unit (in 1990, 1992, and 1998), some elk were fitted with VHF transmitters for subsequent monitoring. These elk were not consistently monitored and basic descriptive information is lacking on movement patterns, habitat use, age/sex compositions, survival, mortality factors, and dispersal/interchange of individuals between subherds, as well as adjacent units. Elk population numbers have increased significantly within the Unit. Below is a partial listing of management activities undertaken and accomplishments within the Unit:

- In 2015, the Department initiated a long-term monitoring project and 32 elk were outfitted with GPS collars.

Unit Specific Research

Bureau of Land Management. 1992. The tule elk of California; 10th annual report to congress. Bureau of Land Management, Sacramento, California, USA.

Literature Cited:

Bureau of Land Management. 1992. The tule elk of California; 10th annual report to congress. Bureau of Land Management, Sacramento, California, USA.

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

McCullough, D.R. 1969. The tule elk; its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Data Tables/Figures

Table 1. A Summary of Population Surveys within the San Luis Reservoir Tule Elk Management Unit, 2001-2016.

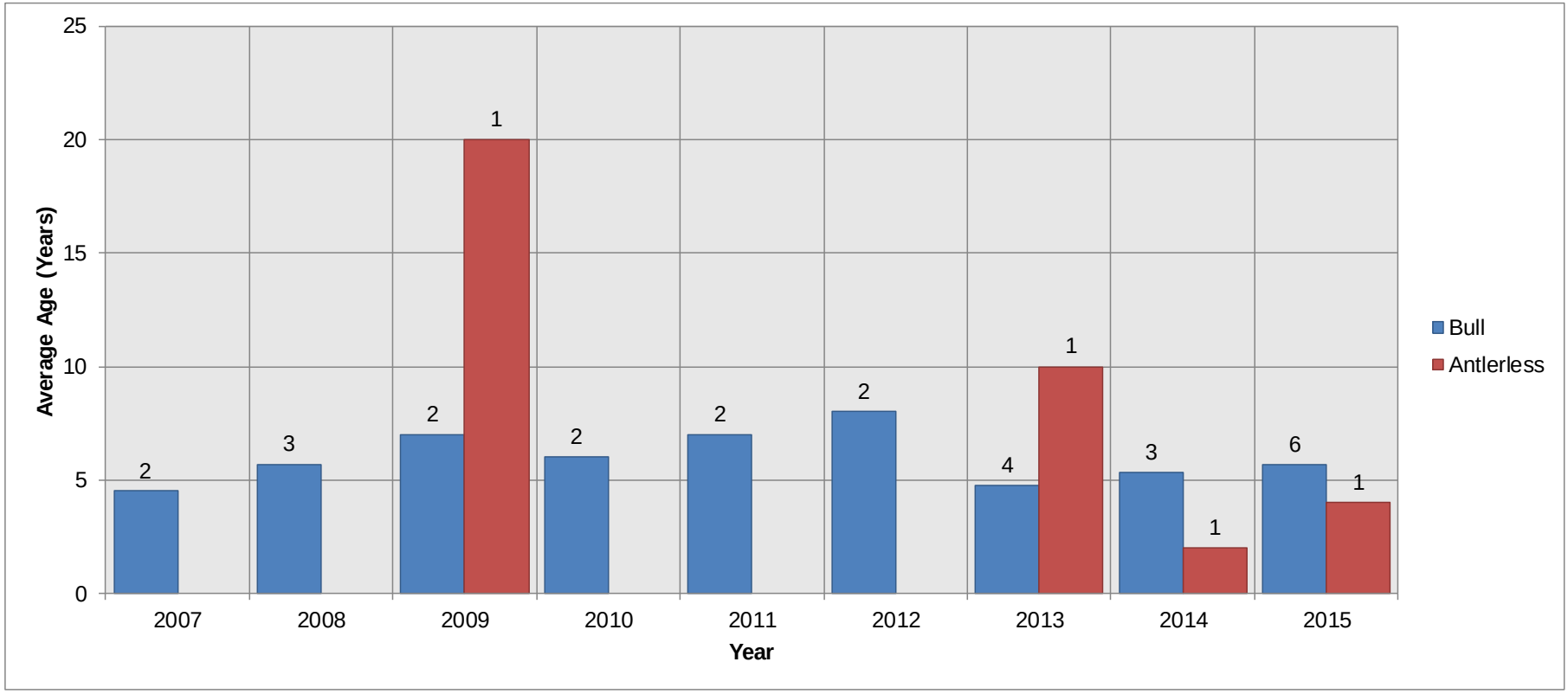
Date	Number of Elk Counted				
Month, Year	**Bulls**	**Cows**	**Calves**	**Unknown**	**Total**
Feb. 2001	17	32	7	0	**56**
Feb. 2002	20	49	3	0	**72**
Jan. 2003	16	41	7	0	**64**
Nov. 2003	13	36	11	0	**60**
Nov. 2004	24	59	22	0	**105**
Nov. 2005	13	51	22	0	**86**
Nov. 2006	26	62	19	1	**108**
Mar. 2008	20			140	**160**
Nov. 2008*	28	150	24	0	**202**
Nov. 2008	34	135	31	0	**200**
Nov. 2009	35	123	28	0	**186**
Nov. 2011	55	92	30	0	**177**
Nov. 2012	23	79	36	10	**148**
2013	No survey conducted in 2013.				
Nov. 2014	52	254	82	3	**391**
Nov. 2015	84	190	58	0	**332**
Nov. 2016	38	127	51	66	**282**

*Survey performed by helicopter. All other surveys were performed with fixed-wing aircraft.

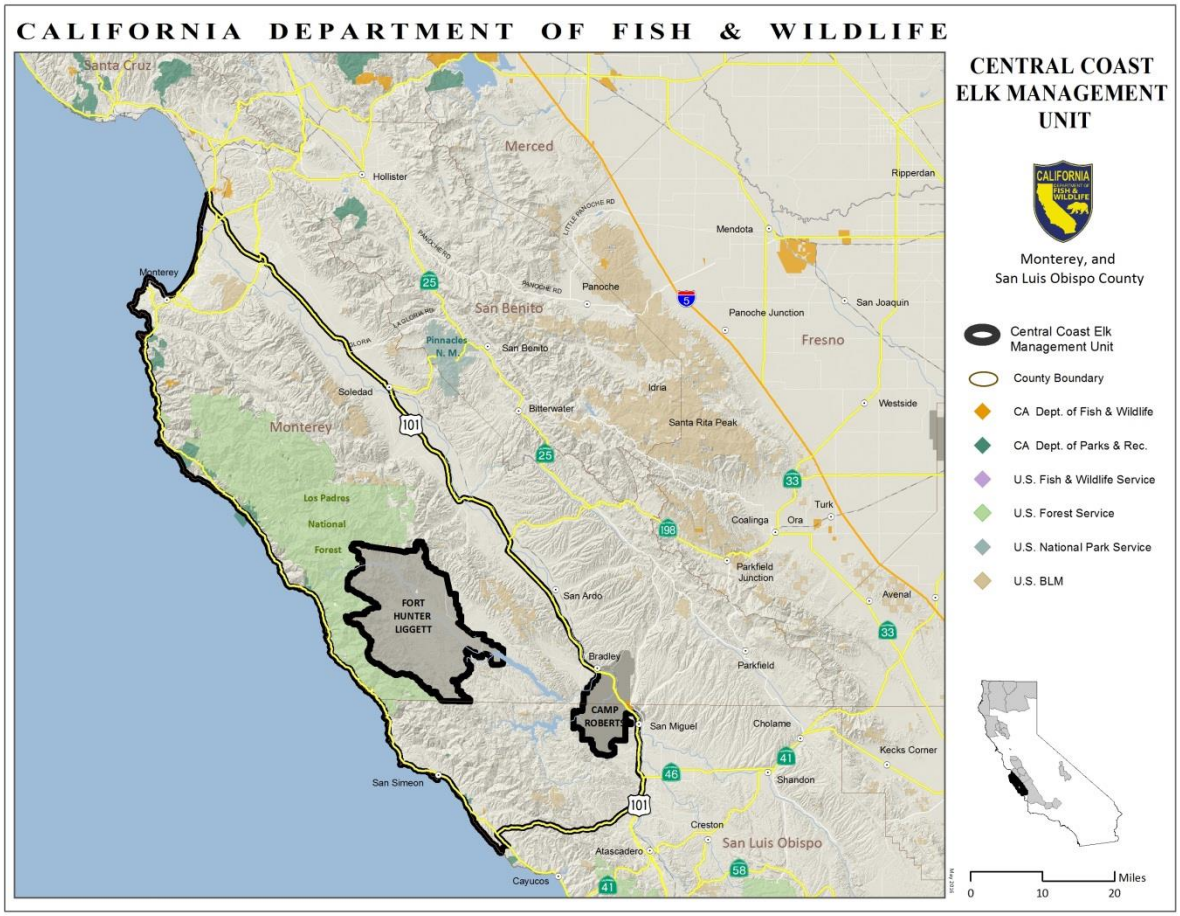
Table 2. San Luis Reservoir Tule Elk Management Unit, Public Quotas/Harvests and Reported Private Lands Management Area Harvests, 2007-2016.

	Public Either-Sex			Cooperative Either-Sex			Reported PLM Harvest		
Year	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Bull Harvest	Antlerless Havest	Bull Harvest	Antlerless Harvest	Number of Ranches
2007	2	2					1	0	1
2008	3	3					2	0	1
2009	3	2	1				2	0	1
2010	3	2					2	0	1
2011	3	3					1	0	1
2012	3	3					1	1	1
2013	3	3					2	1	1
2014	3	3					2	1	1
2015	5	5		1	1		1	1	1
2016	5	5					2	1	1
Totals	**33**	**31**	**1**	**1**	**1**	**0**	**16**	**5**	
Success Rate	**94%**			**100%**					

Figure 1. Average Age of Harvested Elk within the San Luis Reservoir Tule Elk Management Unit, 2007 - 2015. Sample sizes are denoted above bars for each year.



Central Coast Tule Elk Management Unit



Central Coast
Tule Elk Management Unit

Description

The Central Coast Tule Elk Management Unit (Unit) consists of more than 1,807,082 acres in portions of Monterey, San Benito, San Luis Obispo, and Santa Cruz counties. The Unit is bounded by the Pacific Ocean on the west, Highway 101 and 25 on the east, Highway 46 on the South, and Highway 152 to the North.

The Unit is within the Bay Delta and Central Coast Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015), and historical tule elk (*Cervus canadensis nannodes*) range as depicted by McCullough (1969). Vegetation is characterized by chaparral, hardwood/oak woodland, and grassland habitats. Topographical features include flat valley floors, gently rolling hills and steep ridges; elevation varies from sea level to 5,900 feet. Temperatures can reach 100° F in summer and decline below freezing in winter. Numerous reservoirs and catchments are distributed throughout the Unit.

The majority of the Unit is privately owned and used for agricultural crop production and cattle grazing (other land uses include hunt clubs and fuel-wood harvest). Public land includes the Los Padres National Forest, which is immediately adjacent to the northern, western and southern boundaries of Fort Hunter Liggett. Tule elk use of United States Department of Agriculture Forest Service (USFS) and the United States Department of Interior Bureau of Land Management (BLM) land is limited. Elk can be found mostly on private property, including those properties near Fort Hunter Liggett and Camp Roberts, which is generally not accessible to the public. Recreational activities involving elk within the Unit include hunting, photography, wildlife viewing, nature study, and shed collecting. Apart from the Private Lands Management (PLM) program, public access for elk recreational activities is extremely limited.

Elk Distribution and Abundance

In the late-1970s and mid-1980s, tule elk were established at Fort Hunter Liggett (Willison 1986). Elk have dispersed within the last 5-10 years onto private land east of the base near Lockwood, and south of the base towards Lake San Antonio, where conflicts with agricultural and private property have occurred. Elk have also expanded from established groups in northern San Luis Obispo County and southern Monterey County. A limited number of elk from the Camp Roberts unit frequently utilize portions of the Central Coast Unit. The current population estimate for the Unit is 150 animals.

The Hearst Ranch is home to non-native elk. They are remnants of several exotic animals introduced by William Randolph Hearst in the early 1900s. This population

totals approximately 100-150 elk. No comprehensive surveys have been conducted within the Unit due to low elk densities. Adjoining units are surveyed and PLM ranches annually survey elk populations on their properties (Table 1).

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the California Department of Fish and Wildlife (Department) and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 4) alleviate human-elk conflicts and elk depredation complaints. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is increasing and has not reached the upper population identified in Objective 1.5. Population management for this Unit involves efforts to increase elk numbers where suitable, while working to stabilize elk numbers in conflict areas. It will involve a conservative level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict, and focused elk hunting and depredation relief in areas where reoccurring conflict with agriculture and humans exists. The Department will monitor elk on Hearst Ranch in an effort to keep these elk isolated from native tule elk to prevent potential hybridization.

Currently, elk heavily utilize private lands, which in some areas causes conflict with landowners. Expansion of elk use of private lands where elk are tolerated is one method to successfully increase elk populations. Private lands where the presence of elk may be tolerated or encouraged include timberlands, ownerships enrolled in the PLM program, and other properties where elk are desired by the landowner. Where suitable, unoccupied elk habitat exists, management actions should facilitate natural dispersal to reestablish elk where conflicts will be minimal.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with local, state, and federal agencies, Tribes, and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Initiate helicopter surveys (augmented, as necessary, with ground surveys conducted in cooperation with local landowners). Surveys should occur on a three-year rotation. Expected completion: 2021.

Action 1.1.2
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and grazing techniques to benefit elk. Ongoing.

Action 1.2.3
Coordinate with public land agencies, Tribes, and NGOs and establish a timeline to evaluate the potential for elk translocations. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, California Department of Forestry and Fire Protection, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Collaborate with academia to collect habitat use data and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.5
Participate in landscape-level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitat. Ongoing.

Action 1.3.6
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.4.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.4.2
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Action 1.4.3
Monitor elk utilizing the Hearst Ranch and restrict their interaction with native tule elk. Ongoing.

Objective 1.5. Maintain a population of 100-300 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.5.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.5.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes. The Department is committed to working with Tribes on enhancing elk habitat.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes for the development of co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

Currently, only hunting through the PLM program is conducted in this Unit. The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One option is to allocate private-land-only tags that focus harvest on private property to alleviate conflicts.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 3.1. Establish public elk hunting opportunities outside of established PLMs where compatible with population objectives by 2025.

Action 3.1.1
Evaluate the feasibility of establishing a public elk hunting zone with a regulated harvest that is compatible with population objectives. Expected completion: 2022.

Action 3.1.2
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Objective 3.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.2.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Management actions are currently needed in some areas of the Unit where private property conflicts occur and elk populations are increasing.

Private land is essential to the survival of tule elk within the Unit. There is a potential for agricultural/private property conflicts, thus the current population management strategy utilizes limited hunting through the PLM program to provide landowners an incentive to accommodate the needs of tule elk. The current harvest strategy has not yet emphasized controlling population numbers, as private property conflicts to date have been minor. Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program currently is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve tolerance of elk on their properties. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting and co-management with Tribes to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

<u>Objective 4.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.</u>

Action 4.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by reducing/stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 4.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Tule elk within the Unit are generally healthy and have persisted for over 20 years. Non-native elk on the Hearst Ranch have persisted for almost 100 years. All elk groups appear viable, but some groups may be relatively isolated from other management units and might benefit from periodic translocation of individual elk into the Unit on an opportunistic basis. Other groups are known to move from adjoining units (Fort Hunter Liggett and Camp Roberts) into the Central Coast Unit, providing for increased genetic interchange. Human tolerance for elk in the Unit may decline if damage/conflicts escalate in areas.

Summary of Annual Harvests

Tule elk population numbers continued to grow within the Unit. To date, no regulated harvest has occurred outside of PLMs. Table 2 identifies harvest of elk on PLMs.

Unit Highlights

Tule elk (presumably from Camp Roberts, Fort Hunter Liggett, San Luis Obispo County and perhaps other locales) have persisted for over 20 years and appear to be expanding their range within the Unit. Non-native elk on the Hearst Ranch have persisted for almost 100 years.

A partial listing of studies submitted to the Department includes the following:

Unit Specific Research

Fowler, G.S. 1985. Tule elk in California: History, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California, Berkeley, USA.

Literature Cited:

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Willison, J.M. 1986. The tule elk at Fort Hunter Liggett. Thesis, California Polytechnic State University, San Luis Obispo, USA.

Data Tables/Figures

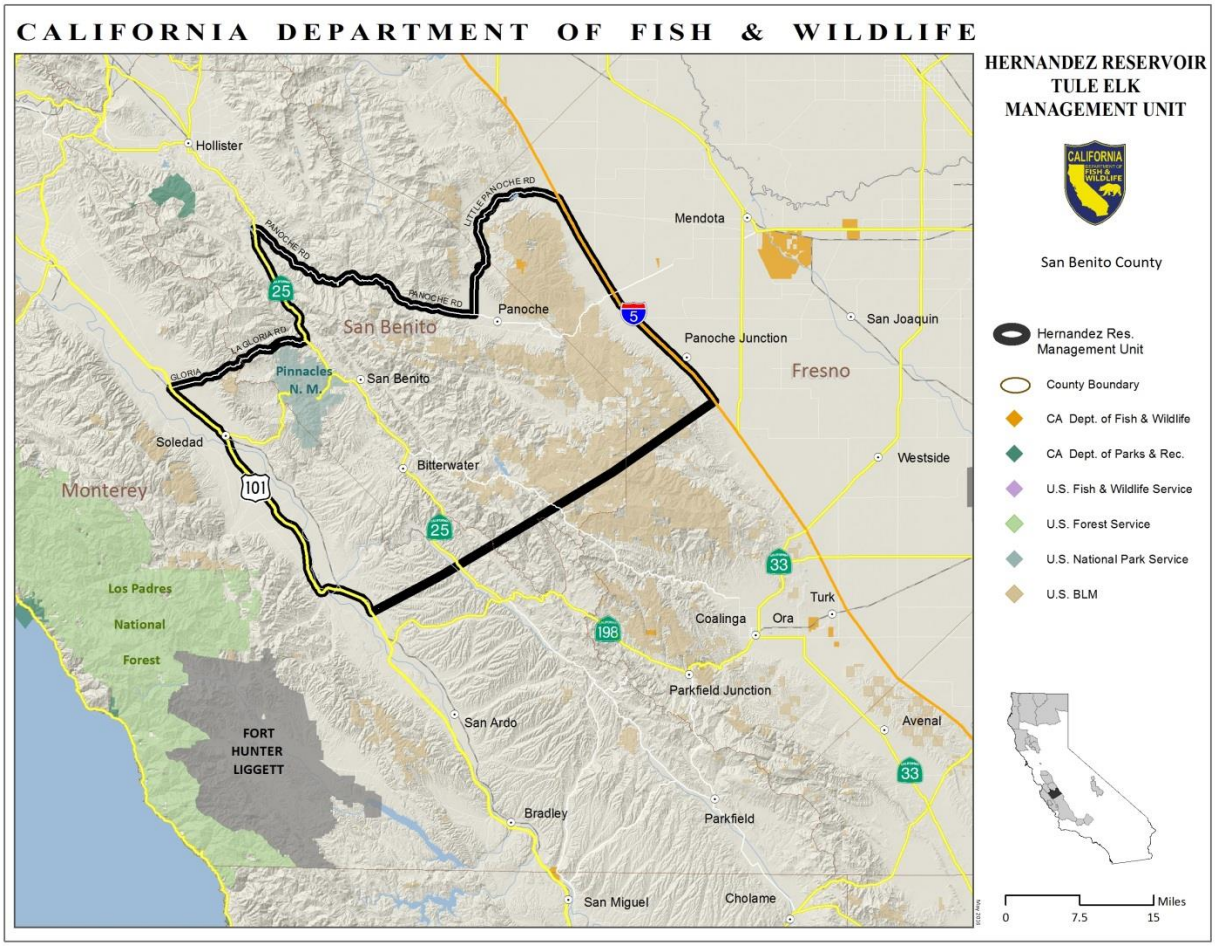
Table 1. Central Coast Tule Elk Management Unit Private Lands Management Area Elk Surveys, 2012-2016.

PLM	Year	Bulls	Antlerless	Calves
Hearst	2012	24	89	9
Hearst	2013	28	90	10
Hearst	2014	31	92	10
Hearst - Partial	2015	21	49	20
Chimney Rock	2015	60	0	0
Chimney Rock	2016	67	0	0

Table 2. Central Coast Tule Elk Management Unit, Reported Private Lands Management Area Harvests (included tule and non-native elk), 2012-2016.

Year	Authorized Bull Tags	Authorized Antlerless Tags	Bull Harvest	Antlerless Harvest	# of PLMs
2012	1	0	1	0	1
2013	1	0	1	0	1
2014	8	6	4	0	2
2015	5	6	4	3	2
2016	6	6	6	2	3
Totals	**21**	**18**	**16**	**5**	

Hernandez Reservoir/South San Benito Tule Elk Management Unit



Hernandez Reservoir/South San Benito Tule Elk Management Unit

Description

The Hernandez Reservoir/South San Benito Tule Elk Management Unit (Unit), formerly referred to as the Southern San Benito County Tule Elk Management Unit, is located in southern San Benito County between the Salinas Valley to the west and the San Joaquin Valley to the east, and includes the south portion of the Diablo Range. At the center of the Unit, Hernandez Reservoir is located approximately 25 miles northeast of King City, California. The southern boundary is about 5 miles south of Hernandez Reservoir; the Unit extends northwest to the junction of Coalinga Road and Old Hernandez Road. The Unit is within the Bay Delta and Central Coast, and the Central Valley and Sierra Nevada Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). It is within historical tule elk (*Cervus canadensis nannodes*) range as depicted by McCullough (1969).

Climate is Mediterranean with hot, dry summers and cool, moist winters. Annual precipitation averages 16.5 inches, 95% of which occurs from October through April. Temperature extremes can exceed 100° F in summer and fall well below 32° F in winter. Topography is characterized by mountains, steep ridges, and narrow valleys; elevations range from 1,200 to 4,500 feet. Hernandez Reservoir and San Benito River are prominent water sources in the Unit.

Vegetation consists of valley grassland, chaparral, and foothill woodland habitats. Eastern foothills contain chamise (*Adenostoma fasciculatum*), and *Ceanothus* as well as oak (*Quercus* spp.) and pine (*Pinus* spp.) covered woodlands; western foothills contain oak woodlands.

The Unit is within boundaries of the La Panza public tule elk hunt zone (see the La Panza Tule Elk Management Unit plan for the boundary description). Most of the Unit consists of private ranches used for livestock grazing and crop production. Access generally is limited to landowners and invited guests. The United States Department of Interior Bureau of Land Management (BLM) administers public land near Hernandez Reservoir (e.g., the Laguna Mountain Recreation Area southwest of Hernandez Reservoir; San Benito Mountain Natural Area, about 10 miles east of Hernandez Reservoir; and Clear Creek southeast of Hernandez Reservoir). These properties are used periodically by tule elk.

Some larger ranches within the Unit are leased by hunting clubs or participate in the Private Lands Management (PLM) program. Recreational activities involving elk within the Unit include hunting, photography, viewing/nature study and shed collecting. However, apart from the hunting programs discussed above, public recreational activities involving elk are extremely limited.

Elk Distribution and Abundance

The Hernandez Reservoir/South San Benito tule elk herd was established in 1985 when 63 elk from the Owens Valley were relocated to the Laguna Ranch in southern San Benito County. The herd was augmented in 1986 when 57 tule elk from Grizzly Island were released on the Circle A Ranch in southern San Benito County. Seven more bulls from San Luis National Wildlife Refuge were released on the Ed Tully Ranch (southern San Benito County) in 1987. Several elk were fitted with VHF transmitters and monitored upon their release. Post-release mortality occurred and initial reproduction was low. In 1988, the Unit contained approximately 65-80 elk (Rohrer and Gutierrez 1988, California Department of Fish and Game 1988).

Non-hunting mortalities from vehicle collisions, illegal take, poison hemlock, and other natural causes have been documented. It is likely that some level of mountain lion predation occurs within the Unit. These mortality factors have not been quantified, but likely combine to control rather than prohibit population growth within the Unit.

Table 1 contains demographic information from population surveys within the Unit. These surveys indicate population numbers are stable to slowly increasing. The current population estimate for the Unit is 225 animals. Improving habitat conditions might support additional elk; however, some landowners have complained about agricultural conflicts and may not tolerate higher elk densities.

Management Goals, Objectives, and Actions

The management goals for this Unit are to: 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions to achieve each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Private land is essential to the survival of tule elk within the Unit. There is a potential for further agricultural/private property conflicts, thus the current population management strategy utilizes hunting through the PLM program to provide landowners an incentive to accommodate the needs of tule elk. The current harvest strategy has not yet emphasized controlling population numbers, as private property conflicts to date have been minor.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population in this Unit is increasing. Population management for this Unit involves efforts to increase elk numbers where suitable, while working to stabilize numbers in conflict areas. The current strategy utilizes hunting mainly through the PLM program to alleviate conflicts and provide landowners an incentive to accommodate the needs of tule elk.

Currently, elk heavily utilize private lands, which in some areas may cause conflict with landowners. Expansion of elk use of private lands where elk are tolerated is one method to successfully increase elk populations. Private lands where the presence of elk may be tolerated or encouraged include timberlands, ownerships enrolled in the PLM program, and other properties where elk are desired by the landowner. Where suitable, unoccupied elk habitat exists, management actions should facilitate natural dispersal to reestablish elk where conflicts will be minimal.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with state and local agencies, and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2024, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue helicopter surveys (augmented, as necessary, with ground surveys conducted in cooperation with local landowners). Surveys should occur on a three-year rotation. Ongoing.

Action 1.1.2
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2024.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to estimate population parameters, such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and grazing techniques that would benefit elk. Ongoing.

Action 1.2.3
Work with land agencies, PLM operators, and other private landowners to develop/improve water sources and calving cover (particularly in riparian areas), remove potential lethal hazards (e.g., old fencing) and install fence crossing structures. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with local agencies, California Department of Forestry and Fire Protection, NGOs, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and local agencies, and private landowners to identify specific areas for prescribed burns that benefit elk. Ongoing.

Action 1.3.4
Work with PLM operators and other private landowners to improve forage conditions by planting grasses/forbs (compatible with sensitive plants) and providing mineral supplements. Ongoing.

Action 1.3.5

Collaborate with academia to collect habitat use data to identify areas utilized by elk and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.6
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.7
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2024.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2022.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 100-250 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review data on an annual basis and adjust population objectives as more information is collected through monitoring, management, and research. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take. One option to alleviate conflicts is to allocate private-land-only tags that focus harvest on private property.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 2.1. Increase elk hunting opportunities by 2023, where feasible and compatible with population objectives.

Action 2.1.1
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Action 2.1.2
Evaluate the feasibility of establishing a separate public hunt for the Unit (currently the Unit is within the La Panza elk hunt zone). Expected completion: 2020.

Action 2.1.3
Complete a new elk hunting environmental document that will analyze additional hunting opportunities. Expected completion: 2020.

Objective 2.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.2.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

To date, human-elk conflicts have been minimal in this Unit. If the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Periodic complaints have involved competition with livestock for forage and fence damage. The PLM program has provided an incentive for participants to modify livestock grazing and otherwise accommodate elk within the Unit. Additionally, elk fence crossing structures can be installed in areas where fence damage is attributed to elk.

If elk distribution expands or population numbers increase, damage and agricultural conflicts could escalate. Controlling population numbers and damage/land use conflicts using regulated hunting may become more challenging because of the prevalence of private land within the Unit. The SHARE program was discussed previously as a potential population management strategy that can improve public access to private (or landlocked public) land. The SHARE program may also assist in managing human-elk conflicts on private land.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program currently is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve their tolerance of elk. Through Cooperative Elk Hunting, PLM, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department emphasizes the use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques, such as fencing and hazing to help alleviate chronic elk depredation problems. However, where hunting and nonlethal methods to alleviate conflict are not successful, the Department will consider issuing depredation permits when readily identifiable animals chronically cause property damage.

Objective 3.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 3.1.1
Map areas of human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture-Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

The Hernandez Reservoir/South San Benito tule elk herd is doing well and population numbers have increased since this herd was reestablished. Complaints regarding private property conflicts within the Unit have been minimal. However, a large cattle ranch in the eastern portion of the Unit has expressed concerns regarding continued elk population growth and range expansion. Based on potential agricultural conflicts, a tentative upper limit of 250 elk has been established for this herd.

The herd appears viable, but is relatively isolated from adjacent management units (e.g., La Panza, Salinas/Fremont Peak and San Luis Reservoir), and might benefit from periodic and opportunistic translocation of individual elk into the Unit.

Summary of Annual Harvests

The Fish and Game Commission authorized annual hunting under the PLM program within the Unit in 1997. Currently, four ranches (Lewis Ranch, Lone Ranch, Rancho La Cuesta, and Trinchero Ranch) hunt tule elk under the PLM program (historical annual harvests are listed in Table 2). Reported harvests have varied, but average approximately four bulls and one antlerless elk per year.

Opportunities for public elk hunting are limited by the availability of public land within the Unit that supports elk. In 2007, the La Panza public tule elk hunt zone was expanded into San Benito County to include private property surrounding Hernandez Reservoir. Most applicants drawn for the La Panza hunt have concentrated their hunting efforts in the southern portion of the La Panza zone where public land that contains elk is more abundant and accessible. Harvest of elk through public hunting within the Unit is minimal.

The mean age of antlered (bulls) and antlerless elk taken within the Unit since 2003 is listed in Figure 1. Annual sample sizes are relatively small, and in some years samples were not collected. Mean age of bulls ranged from 2.0-10.0 years, whereas mean age of antlerless elk was 5.0 years.

The cumulative reported harvest has consisted primarily of bulls (Table 2), which facilitated continued elk population growth for the Unit. As the elk population density increases, private property conflicts may occur and/or intensify, which might necessitate the increased harvest of antlerless elk to control population numbers.

Unit Highlights

Cooperation and support of private landowners is essential in maintaining the Hernandez Reservoir/South San Benito herd. While habitat conditions generally are good, collaboration with private landowners, particularly PLM program participants, will be important for this herd to continue to thrive. The Department has collaborated with private landowners and the academic community to develop plans and programs to manage tule elk. Below is a partial listing of these activities:

- In 1988, the Department prepared the Southern San Benito County Tule Elk Management Unit Management Plan.

- Fowler (1985) reviewed the status of tule elk in California, including those in southern San Benito County.

- In the mid-1980s, The Department collaborated with the Humboldt State University Foundation to monitor dispersal of elk re-introduced to the Laguna Mountain area in southern San Benito County.

A partial listing of these and other studies submitted to the Department includes the following:

Unit Specific Research

Fowler, G.S. 1985. Tule elk in California: history, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California, Berkeley, USA.

Rohrer, J.J. 1990. Habitat selection by reintroduced tule elk. Thesis, Humboldt State University, Arcata, California, USA.

Voelker, B.W. 2010. Ventana ranch resource management plan 2010. Thesis, University of California, Berkeley, USA.

Literature Cited:

California Department of Fish and Game. 1988. Southern San Benito County tule elk management unit management plan. Unpublished report. California Department of Fish and Game, Sacramento, USA.

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Rohrer, J.J. and R.J. Gutierrez. 1988. Movements and dispersal of the Laguna Mountain tule elk herd. Unpublished report to the California Department of Fish and Game.

Data Tables/Figures

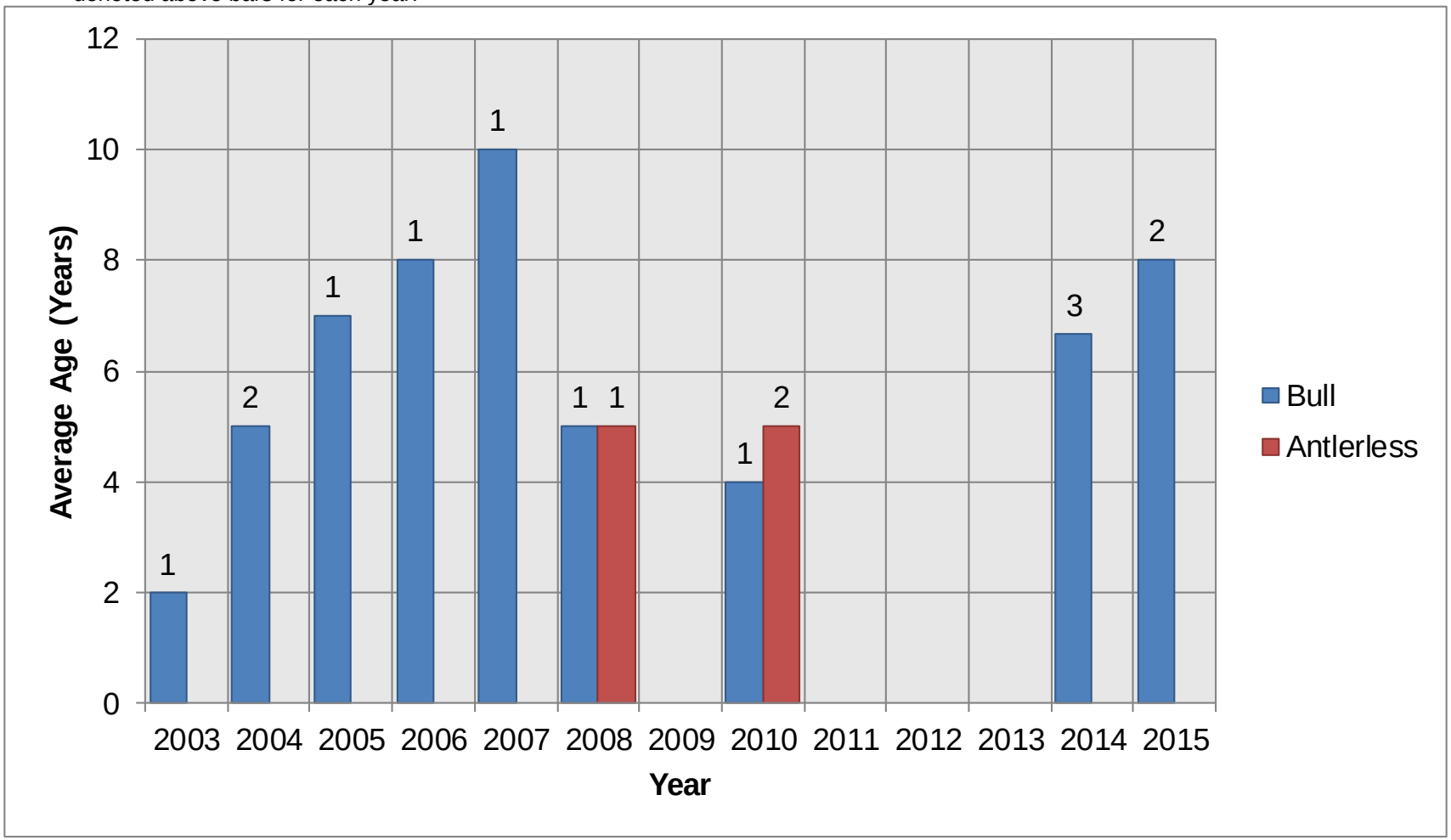
Table 1. Hernandez Reservoir/South San Benito Tule Elk Management Unit Elk Surveys.

Date	Bulls	Cows	Calves	Unclassified	Total	
2006	20	103	31		154	CDFW Helicopter
2007	22	85	17		124	CDFW Helicopter
2010				150	150	Trinchero Ranch -estimate
2010				125	125	Lone Ranch-estimate
2015	18			125	143	Lone Ranch
11/16/2014				41	41	Lewis Ranch
12/30/2014				12	12	Lewis Ranch
3/20/2015				8	8	Lewis Ranch
4/4/2015	5				5	Lewis Ranch
5/5/2015	8		8	45	61	Lewis Ranch
5/12/2015				37	37	Lewis Ranch
5/19/2015	2			40	42	Lewis Ranch
5/22/2015	4			90	94	Lewis Ranch
7/4/2015	4				4	Lewis Ranch
7/27/2015				66	66	Lewis Ranch
8/21/2015				12	12	Lewis Ranch
9/16/2015				115	115	Lewis Ranch
12/8 - 12/9/2016	51	132	13		196	CDFW Helicopter

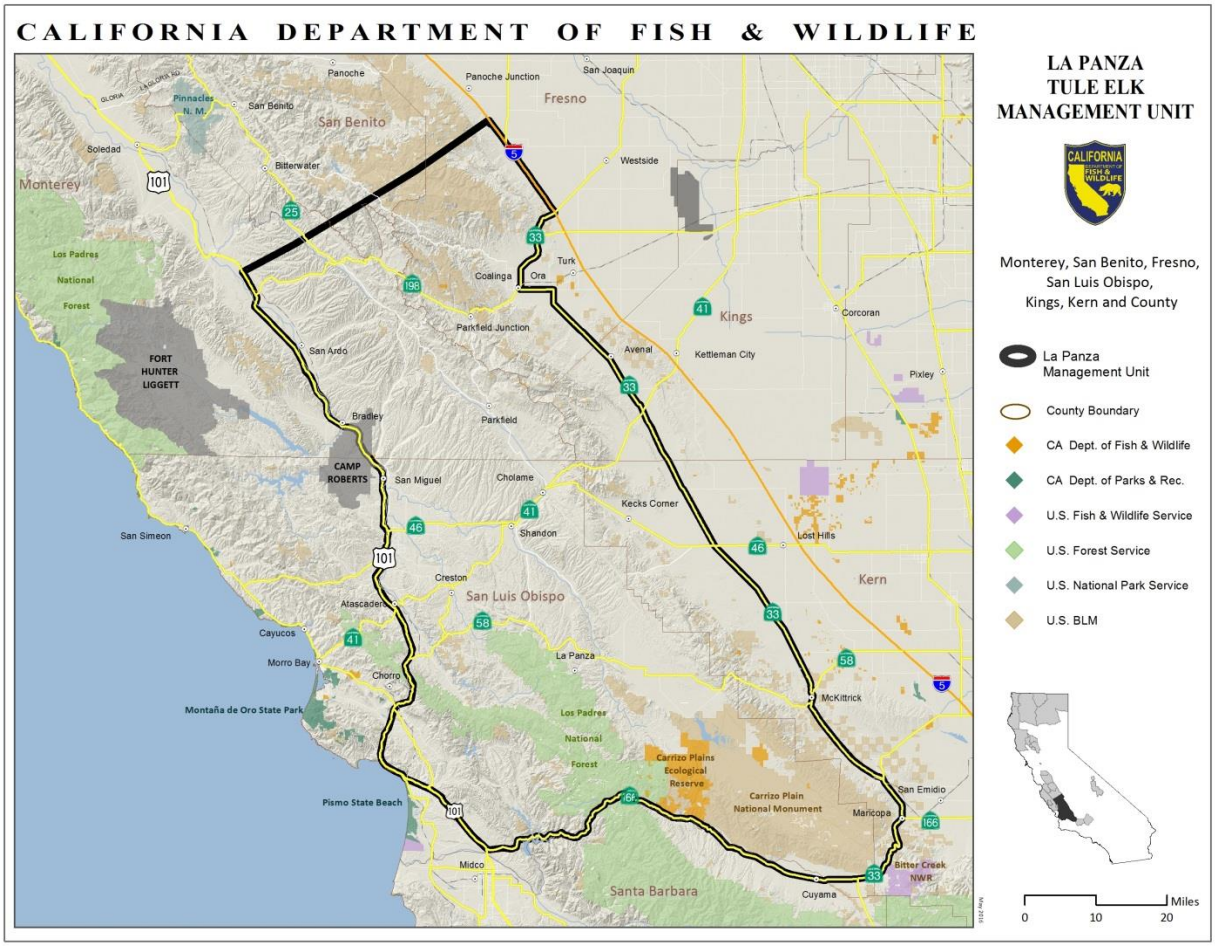
Table 2. Reported Private Lands Management Area Harvests, Hernandez Reservoir/South San Bonito Tule Elk Management Unit, 1997-2016.

Year	Reported PLM Harvest		
	Bull Harvest	Antlerless Harvest	Number of Ranches
1997	0	0	1
1998	1	0	1
1999	2	0	1
2000	2	0	1
2001	0	0	1
2002	2	0	2
2003	8	0	3
2004	7	3	3
2005	9	1	3
2006	7	1	3
2007	7	1	3
2008	3	3	4
2009	5	3	4
2010	7	3	4
2011	5	1	4
2012	3	2	4
2013	4	3	4
2014	7	1	4
2015	6	2	4
2016	6	2	4
Totals	**91**	**26**	

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting within the Hernandez Reservoir/South San Benito Tule Elk Management Unit, 2003 - 2015. Sample sizes are denoted above bars for each year.



La Panza Tule Elk Management Unit



La Panza
Tule Elk Management Unit

Description

The La Panza Tule Elk Management Unit (Unit) is 3,654,710 acres described as follows: In those portions of Fresno, Kern, Kings, Monterey, San Benito, and San Luis Obispo counties within a line beginning in Monterey County on Highway 101, five miles south of King City; south along Highway 101 to Highway 166 in San Luis Obispo County; east along Highway 166 to Highway 33 at Maricopa in Kern County; north and west along Highway 33 to Highway 198 at Coalinga in Fresno County; north along Highway 33 to Interstate Highway 5; north along Interstate Highway 5 to five miles south of Panoche Junction; southwest in a straight line to the point of beginning.

The Unit is within the Bay Delta and Central Coast, and the Central Valley and Sierra Nevada Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015); and historical tule elk (*Cervus canadensis nannodes*) range as depicted by McCullough (1969). Elevation varies from 1,500 ft. in the western portion to 5,100 ft. at Caliente Mountain. Summer daytime temperatures can exceed 100º F; winter temperatures can decline to 0º F. The Unit contains large areas of typical inner coast range vegetation dominated by chamise chaparral, mixed chaparral, oak woodland/savannah, open valley grassland, juniper-oak woodland, desert scrub, and dryland agricultural fields. Terrain varies from essentially flat in the Carrizo Plains to steep and rugged in the La Panza and Caliente Mountain ranges. There are no major water courses with free flowing perennial water within the Unit. However, the Salinas River is along the western edge, with headwaters near the center of the Unit, and the Cuyama River is along the southern edge.

Approximately 20% of the Unit is privately owned. Private land is used primarily for livestock grazing and crop production. Access is generally limited to landowners and invited guests. Vineyards and solar projects are emerging uses that could affect tule elk in the Unit.

Public land in the Unit is administered by the United States Department of Agriculture Forest Service (USFS; Los Padres National Forest), the United States Department of Interior Bureau of Land Management (BLM; Bakersfield District), and the California Department of Fish and Wildlife (Department). The Nature Conservancy has acquired private land in and near the Carrizo Plains. BLM and the Department have acquired several large parcels over the last 20 years to improve public access.

Recreational activities involving elk within the Unit include hunting, viewing/nature study, and shed collecting. Vehicular access along some unpaved roads is restricted by wet weather or road conditions. Access to other areas is prohibited to protect vulnerable species or habitats. Access to the American and South Chimineas subherds is good.

Elk Distribution and Abundance

Initial efforts to reintroduce tule elk to the La Panza Unit began in 1983 when the Department brought 20 elk from the Tupman Tule Elk State Reserve in Kern County to a private ranch in the Pozo area. In 1985, the Department brought 103 more elk from the Owens Valley and 16 elk from Potter Valley to private ranches near Pozo and the Carrizo Plains. Elk have since dispersed from these sites and formed distinct subherds on public and private property.

The La Panza Tule Elk Management Unit Plan (California Department of Fish and Game 1988) identified the following subherds within the Unit: Big Rocks, located in the southwest portion of the Unit (now called the Stanley Mountain subherd); Carrizo Canyon, located in the south-central portion of the Unit (now called the South Chimineas subherd); Freeborn Mountain, located south of Highway 58) (now called the American subherd); Mustang Spring, located north of Highway 58 (now called the California Valley subherd); Yeaguas Mountain, located north of Highway 58 (now also called the California Valley subherd); and Carneros Rocks, located north of Highway 58 (also referred to as the Cedar Canyon subherd).

Additional subherds now recognized include the Pozo, Avenales, and San Juan subherds located south of Highway 58 and north of Highway 166 near the east boundary of the Los Padres National Forest; and the Cholame (also referred to as Shandon) subherd in northern San Luis Obispo County. The public hunt boundary for the La Panza Unit was expanded to include the Indian Valley (also referred to as San Miguel) subherd in northern San Luis Obispo/southern Monterey counties, and the Peachtree Valley and Priest Valley subherds in Monterey County. Tule elk from the Hernandez Reservoir/South San Benito unit are within geographic boundaries of the La Panza public hunt zone, for which a separate plan has been prepared.

The La Panza herd has grown rapidly, and has been the largest tule elk herd in the State since 1994. The current population estimate is 800 animals. Some subherds are still growing, others appear stable, and some may be in decline or are becoming more restricted in distribution because of local habitat conditions. Non-hunting mortalities from predation, poaching, and roadways have occurred, and a mortality from anthrax was suspected, but not confirmed. These mortality factors have not been quantified, however they have not suppressed elk population growth in the Unit.

In 2011, construction began on two large solar plants in California Valley on the northern portion of the Carrizo Plain, within the California Valley subherd boundaries. These plants were completed and operational by the end of 2014. Collectively, they converted approximately 5,500 acres of previously occupied elk habitat, which also provided habitat for endangered species such as San Joaquin kit fox. Both solar companies were required to mitigate for the loss/alteration of endangered species habitat by acquiring and transferring fee title and conservation easements for

approximately 21,300 acres of suitable replacement habitat in the northern Carrizo Plains. Of these lands, the Department now holds fee title to 12,150 acres, and a conservation easement on the remaining 9,150 acres. These lands must be managed as kit fox habitat.

To settle litigation regarding habitat loss, both solar companies purchased 9,100 additional acres of wildlife habitat. The intent of these acquisitions is to conserve habitat for various wildlife species including pronghorn and tule elk.

The Department has monitored population parameters (age, sex ratios, and minimum population numbers) of the La Panza herd with annual fixed-wing aircraft and helicopter surveys (Table 1). Some subherds are well established (Stanley Mountain, South Chimineas, American, California Valley, and Cedar Canyon) and should continue to support at least 800 elk, assuming private property conflicts remain minimal. Surveys conducted on Private Lands Management (PLM) ranches are recorded in Table 2.

Management Goals, Objectives, and Actions

The management goals for this Unit are to: 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population in the Unit is increasing. Population management includes efforts to increase elk numbers where suitable, while minimizing or alleviating conflicts on private land and providing appropriate hunting opportunities. Specific harvest strategies vary for subherds based on local conditions, such as prevailing land ownership (public or private), potential competition with livestock (or actual damage to crops or fences), habitat quality/quantity, the potential for damage to sensitive habitats, or conflicts with other wildlife species.

Elk heavily utilize private lands and is essential to the survival of tule elk within the Unit. There is a potential for agricultural/private property conflicts in some areas that may cause conflict with landowners. The current population management strategy utilizes hunting to provide landowners an incentive to accommodate the needs of tule elk, while minimizing conflicts. Private lands where the presence of elk may be tolerated or encouraged include ownerships enrolled in the PLM program, and other properties where elk are desired by the landowner. Where suitable, unoccupied elk habitat exists,

management actions should facilitate natural dispersal to reestablish elk where conflicts will be minimal.

Portions of the Unit contain large private parcels where livestock (primarily cattle) grazing occurs, and human use is restricted to landowners and their guests. In some instances, population levels for some subherds may be controlled or reduced with liberal PLM harvests (e.g., California Valley, Cedar Canyon/Carneros Rocks, Cholame). However, more conservative harvests are in place for subherds on public and private land that are below habitat carrying capacity and not causing conflicts.

Objective 1.1. Continue and complete projects to estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue helicopter surveys and fixed-wing aircraft surveys. Helicopter surveys should occur on a three-year rotation with fixed-wing surveys conducted on an annual basis. Ongoing.

Action 1.1.2
Continue the current radio telemetry (GPS/VHF) collar study to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Continue elk habitat mapping project and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and grazing techniques that would benefit elk. Ongoing.

Action 1.2.3
Work with land agencies, PLM operators, and other private landowners to develop/improve water sources and calving cover (particularly in riparian areas), remove potential lethal hazards (e.g., old fencing) and install fence crossing structures. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Complete current elk habitat mapping project to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with local agencies, California Department of Forestry and Fire Protection, NGOs, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and local agencies, and private landowners to identify specific areas for prescribed burns that benefit elk. Ongoing.

Action 1.3.4
Work with PLM operators and other private landowners to improve forage conditions by planting grasses and forbs (compatible with sensitive plants) and provide mineral supplements. Ongoing.

Action 1.3.5
Collaborate with academia to collect habitat use data to identify areas utilized by elk and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.6
Participate in landscape-level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitat. Ongoing.

Action 1.3.7
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the

effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Action 1.3.8
Review the feasibility of using recent solar plant mitigation lands to maintain and/or improve habitat conditions for wild ungulates. Expected completion: 2021.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2024.

Action 1.4.1
Collaborate with academia on cause-specific mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2022.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 500-1,200 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term growth of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review population objectives for established subherds (e.g., American, South Chimineas, and California Valley subherds) and specify desired population objectives for recently established subherds based on carrying capacity and human-elk conflicts. Expected completion: 2021.

Action 1.6.3
Review data on an annual basis and adjust population objectives as information is collected through monitoring, management, and research. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take.

One option to alleviate conflicts is to allocate private-land-only tags that focus harvest on private property. Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits. Other projects to improve public hunting access on private land have yet to be implemented within the Unit, but as additional landowners learn about the SHARE program, public access opportunities for elk hunting may increase.

<u>Objective 2.1. Increase elk hunting opportunities by at least 10% by 2023, where feasible and compatible with population objectives.</u>

Action 2.1.1
Develop specific elk hunting boundaries to sub-divide the Unit into multiple elk zones, to better manage harvest and provide additional hunt periods. Expected completion: 2020.

Action 2.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Action 2.1.3
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Objective 2.2. Work with other agencies and NGOs to install one elk interpretive sign by 2023.

Action 2.2.1
Meet with land agencies to evaluate the possibility of adding and/or updating elk interpretive signs. Expected completion: 2020.

Action 2.2.2
Evaluate the feasibility of adding an elk interpretive sign to the Carrizo Plains Ecological Reserve. Expected completion: 2020.

Objective 2.3. Conduct an elk workshop to inform the public about elk and elk viewing opportunities by 2023.

Action 2.3.1
Work with agencies, academia, and NGOs to provide information on elk and elk viewing at the workshop. Expected completion: 2022.

Objective 2.4. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.4.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

If the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Periodic complaints have involved competition with livestock for forage and fence damage. The PLM program has provided an incentive for participants to modify livestock grazing and otherwise accommodate elk within the Unit. Additionally, fence-crossing structures can be installed in areas where fence damage is attributed to elk.

If elk distribution expands or population numbers increase, damage and agricultural conflicts could escalate. Controlling elk population numbers and damage or land use conflicts with regulated hunting may become more challenging because of the prevalence of private land within the Unit. The SHARE program is a potential population management strategy that can improve public access to private (or landlocked public) land. The SHARE program may also assist in controlling elk population numbers and managing private land conflicts that involve elk.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The hunting program currently is not designed to reduce population numbers over the entire Unit, although short-term reductions may occur within localized areas. Annual harvests can be adjusted to address human-elk conflicts. Where substantial conflicts occur, implementation of elk population control, non-lethal elk exclusion/deterrence tactics, and additional management actions may occur, while maintaining a viable elk population. Providing and improving opportunities for landowners to benefit from having elk on their property may improve tolerance of elk on their properties. Through Cooperative Elk Hunting, PLM, and SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department emphasizes the use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. However, where hunting and nonlethal methods to alleviate conflict are not successful, the Department will consider issuing depredation permits when readily identifiable animals chronically cause property damage.

Objective 3.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 3.1.1
Map areas of human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation.
Ongoing.

Herd Viability

There is a potential for natural interchange of individuals from the La Panza Unit with individuals from the Fort Hunter Liggett, Camp Roberts, Hernandez Reservoir, and San Emigdio units. At some time after 1989, at least 50 elk left Camp Roberts and moved north. Some of these may have moved into the La Panza Unit (California Department of Fish and Game 1991), or to Fort Hunter Liggett. However, the Department did not detect movement of VHF-collared individuals between these units after 1985, nor of 55 elk fitted with GPS transmitters since 2004.

It is likely that natural interchange of individuals occurs between subherds within the La Panza Unit (California Department of Fish and Game 1988, Phillips and Kutilek 1988). Bulls fitted with GPS transmitters have moved between different subherds. Additionally, the Department periodically translocates individuals and small groups of elk into the Unit from the San Luis National Wildlife Refuge, Tupman Tule Elk State Reserve, and Concord Naval Weapons Station since 1989 (Table 4), and translocated elk into the northern portions of the Unit from 1985-2000 (Table 5). These actions contributed to genetic diversity and herd viability. Translocations will continue as funding allows and surplus animals are available.

The La Panza tule elk herd has been established for more than 30 years. The population has grown rapidly and is still increasing. Habitat conditions should support additional population growth, especially on public land. It appears that the mean annual harvest level (approximately seven percent of the current minimum population size) can be sustained for a prolonged period. Ongoing monitoring of sex and age ratios for each subherd is important, along with the age structure of the harvest for each subherd, to ensure that a concentrated liberal harvest within a particular subherd does not have adverse impacts.

Summary of Annual Harvests

The Fish and Game Commission (FGC) authorized annual public elk hunting within the La Panza Unit in 1993 (annual quotas and harvests are listed in Table 3). In total, 564 public tags were issued for the Unit from 1993-2016; this harvest level should facilitate continued elk population growth on public land within the Unit.

In 1994, the FGC authorized elk hunting under the PLM program within the Unit. Since then, 12 ranches have been licensed to hunt elk under the PLM program. Over time some properties withdrew from the program, others came into public ownership and were removed, while others continued in the program upon changing ownership. As of

2015, ten ranches with a combined total of over 113,000 acres were licensed to hunt elk within the Unit. Reported annual PLM elk harvest often exceeds annual public harvest (Table 3).

Cooperative Elk Hunting tags first became available in 2000 and have been issued annually. These tags must correspond to current public tag designations and are limited to 20% of the public quota. Thus, up to two antlerless and two bull tags have been available each year for Cooperative Elk Hunting within the La Panza Unit. Most of the harvest under this program has consisted of bulls as there is less demand for antlerless tags.

The public hunt zone has expanded since the hunt first occurred in portions of San Luis Obispo, Santa Barbara, and Kern counties. The Department extended the boundaries in 2004 and 2007, and the public hunt zone now includes portions of seven California counties, and is approximately four times the size of the initial zone. However, public tag quotas have not increased since 1994, except for a slight increase through Cooperative Elk Hunting.

Public and PLM tags are designated as either antlerless or bull tags, which allows the Department to stratify harvest by sex. The current harvest strategy has resulted in a cumulative take (public and PLM combined) of more bulls than cows, which allows the elk population for the entire Unit to continue to grow. The harvest strategy for the public hunt involves a 23-day hunting season (per hunt period) to reduce crowding, provide for a quality hunting experience, and optimize success. If it becomes necessary to stabilize or reduce the size of a particular subherd, the Department may recommend a more liberal harvests to achieve a higher take of cow elk.

In addition to annual elk population surveys, hunt program monitoring requires mandatory tag return/reporting, and encourages submission of elk tooth samples for age analysis. This provides the Department with information to estimate annual harvest success rates, and provides age information that may be indicative of the age structure of the population.

The mean age of bulls taken within the Unit since 1994 by public hunting ranged from 2.8-7.0 years, whereas that of antlerless elk ranged from 2.5-11.0 years (Figure 1). The mean age of bulls taken through the PLM program since 1994 ranged from 2.8-8.0 years, whereas antlerless elk ranged from 3.4-11.0 years (Figure 2). The majority of elk taken by hunting within the Unit were reproductively mature and survived through at least one reproductive cycle.

The mean annual harvest for the La Panza Unit (public and PLM combined) is approximately 30 bulls and 27 antlerless elk (Table 3). Reported PLM harvests exceed corresponding public harvests, however the total mean annual harvest is only approximately seven percent of the reported minimum population. Observed bull to cow ratios (Table 1) are above the minimum objective of 25 bulls per 100 cows and calf recruitment appears sufficient to sustain the current harvest level indefinitely.

Unit Highlights

Cooperation and support from private landowners was essential in reestablishing the La Panza herd, now the largest tule elk herd in California. While habitat conditions are generally good, private landowner support has been and likely will continue to be essential in maintaining this herd. Collaboration with private landowners will be important for this herd to continue to thrive. The Department has collaborated with private landowners and the academic community to develop plans and programs to manage tule elk on the Unit. Below is a partial listing of these activities:

- In 1988, the Department prepared the La Panza Tule Elk Management Unit Management Plan.
- In the mid-1980s, the Department collaborated with academic institutions to monitor elk reintroduced to San Luis Obispo County. Resulting reports/publications included Fowler (1985), Phillips and Kutilek (1988), and Rohrer (1990).
- From 2002-2004, the Department acquired large parcels of private land increasing public access.
- From 2001-2014, at least eight water improvement or development projects were completed.
- Since 2004, 55 elk have been outfitted with GPS collars to monitor movements, home range, and habitat use.
- Habitat use and home range was analyzed utilizing data from GPS collars and presented at the Western Section of the Wildlife Society 2013 Meeting (Stafford and Hobbs 2013).

A partial listing of products from these and other studies submitted to the Department includes the following:

Unit Specific Research

Fowler, G.S. 1985. Tule elk in California: history, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California, Berkeley, USA.

Rohrer, J.J. 1990. Habitat selection by reintroduced tule elk. Thesis, Humboldt State University, Arcata, California, USA.

Stafford, R., and J.H. Hobbs. 2013. Habitat use and home range estimates for tule elk in eastern San Luis Obispo County. Presented at the Western Section of the Wildlife Society 2013 Meeting; abstract available at: <http://wildlifeprofessional.org/western/tws_abstract_detail.php?abstractID=469>.

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California Department of Fish and Game. 1991. Tule elk in California: a report to the legislature. Unpublished report. California Department of Fish and Game, Sacramento, USA.

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in, Zoology 88. University California Press, Berkeley, USA.

Phillips, J.A., and M.J. Kutilek. 1988. Pozo tule elk subherds, San Luis Obispo County, California. California Department of Fish and Game, Sacramento, USA.

Data Tables/Figures

Table 1. La Panza Tule Elk Management Unit Elk Surveys.

Note: H denotes helicopter surveys; FW denotes fixed-winged aircraft surveys.

Year	Number of Elk Observed					Survey Mode	Notes
	Bulls	Cows	Calves	Not Classified	Total		
1987	22	72	16	7	117		Source: 1988 La Panza Unit Management Plan. Survey Method Unknown.
1988					137		Source: 1988 La Panza Mgt. Plan. Survey Method Unknown, Yeagus Mtn. Not Surveyed.
1992	50	101	45	0	196	H	Observed Numbers Reconstructed from Composition Ratios.
1993	64	151	79	0	294	H	Reported Pop ≥ 350, in '93 FED. Observed Numbers Reconstructed from Composition Ratios.
1994	92	231	69	0	392	H	Reported Pop ≤ 600, in '94 FED. Observed Numbers Reconstructed from Composition Ratios.
1995					Almost 500		Reported Pop 600, in '95 FED.
1996							Reported Pop ≥ 650, in '96 FED.
1997							Reported Pop ≥ 750, in '97 FED.
1998					Almost 500		Reported Pop ≥ 750, in '98 FED.
1999	119	232	77	0	428	H	Reported Pop ≥ 750, in '99 FED. Observed Numbers Reconstructed from Composition Ratios.
2000	113	424	74	0	611	H, FW	Reported Pop ≥ 750, in '00 FED. FW: Clark/White, Cal Valley North. Stanley Mtn. Not Surveyed.
2001	130	311	97	0	538	H, FW	Reported Pop > 800, in '02 FED. FW: Clark/White, Cal Valley North.
2002	128	302	66	0	496	H, FW	Reported Pop > 800, in '02 FED. FW: Clark/White. Stanley Mtn. Not Surveyed.
2003	139	338	97	0	574	H, FW	Reported Pop > 800, in '03 FED. FW: Clark/White, American. Stanley Mtn. Not Surveyed.
2004	174	353	75	0	602	H, FW	Reported Pop > 800, in '04 FED. FW: American, Pozo, Avenales, Clark/White, Cal Valley North.
2005	115	357	87	0	559	H, FW	FW: American, Pozo, Avenales, Clark/White, Cal Valley North.
2006	119	324	100	0	543	H, FW	FW: American, Pozo, Avenales, Clark/White, Cal Valley North.
2007	152	422	62	0	636	H, FW	FW: Clark/White, Cal Valley North.
2008	140	362	97	0	599	H, FW	FW: Clark/White, Cal Valley North. Stanley Mtn., Indian Valley Not Surveyed.
2009	142	434	89	0	665	H, FW	FW: Clark/White, Cal Valley North. Indian Valley Not Surveyed.
2010	78	245	65	0	388	FW	Stanley Mtn., Pozo, Avenales, Indian Valley Not Surveyed.
2011	81	296	83	0	460	FW	Stanley Mtn., Pozo, Avenales, Indian Valley Not Surveyed.
2012	90	215	50	0	355	FW	Stanley Mtn., Indian Valley Not Surveyed
2013	81	283	23	0	387	FW	Stanley Mtn, Pozo, Avenales, Indian Valley, Cedar Canyon not surveyed
2014	96	367	49	0	512	FW	Stanley Mtn, Pozo, Avenales, Indian Valley not surveyed
2015	82	347	7	0	436	FW	Stanley Mtn, Avenales, Indian Valley, Cedar Canyon not surveyed
2016	61	250	5	0	316	H	CDFW files, December 8-9, 2016. Areas surveyed: Lombardo/Camp 5, San Miguel, Big Sandy, Bradley, Peach Tree Ranch, Bitterwater and Priest Valley

Table 2. Peach Tree Ranch Private Lands Management Area Tule Elk Surveys.

Date	Bulls	Cows	Calves	Total
June 15, 2011	22	26	10	**58**
July 7, 2011	23	36	11	**70**
August 5, 2011	24	29	9	**62**
September 30, 2011	24	36	10	**70**
October 15, 2011	29	43	8	**80**
November 10, 2011	33	38	7	**78**
December 14, 2011	17	28	4	**49**
January 19, 2012	40	87	15	**142**
February 8, 2012	18	54	8	**80**
February 23, 2012	33	54	3	**90**
March 29, 2012	40	62	0	**102**
April 11, 2012	35	54	10	**99**
May 2, 2012	38	58	5	**101**
May 31, 2012	43	71	11	**125**
June 21, 2012	42	73	12	**127**
June 29, 2012	44	81	13	**138**
July 23, 2013	43	92	14	**149**
August 3, 2012	37	78	10	**125**
August 20, 2012	42	85	12	**139**
September 26, 2012	50	97	23	**170**
November 6, 2012	34	67	11	**112**
December 14, 2012	40	99	15	**154**
December 27, 2012	26	72	9	**107**
January 16, 2013	20	113	0	**133**
February 20, 2013	19	111	0	**130**
March 13, 2013	16	85	0	**101**
April 8, 2013	20	114	0	**134**
May 15, 2013	30	89	22	**141**
June 19, 2013	48	92	35	**175**
July 15, 2013	55	85	31	**171**
August 1, 2013	52	74	39	**165**
September 26, 2013	53	88	36	**177**
October 9, 2013	47	102	45	**194**
November 19, 2013	50	89	40	**179**
December 20, 2013	53	101	43	**197**
January 23, 2014	53	115	25	**193**
February 25, 2014	53	98	31	**182**
March 28, 2014	50	121	18	**189**
May 28, 2014	60	112	45	**217**
June 18, 2014	64	115	41	**220**
July 13, 2014	65	125	39	**229**
September 23, 2014	55	117	29	**201**
October 23, 2014	58	127	28	**213**
November 13, 2014	47	103	27	**177**
December 20, 2014	48	129	18	**195**
January 15, 2015	55	121	22	**198**
February 16, 2015	54	119	29	**202**
March 25, 2015	57	126	22	**205**
April 14, 2015	64	127	41	**232**
May 20, 2015	74	131	45	**250**
June 16, 2015	83	132	49	**264**
July 13, 2015	76	133	51	**260**
August 26, 2015	67	101	43	**211**
September 29, 2015	63	109	39	**211**
November 4, 2015	37	120	9	**166**
November 13, 2015	74	130	25	**229**

Table 3. La Panza Tule Elk Hunt, Public Tag Quotas and Harvests, and Reported Private Lands Management Area Harvests, 1993-2016.

Year	Bull		Antlerless		Apprentice Bull		Apprentice Antlerless		Cooperative Elk Hunting			Reported PLM Harvest		
	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	Bull Harvest	Antlerless Harvest	Number of Ranches
1993	6	4	6	1										
1994	12	6	12	2								1	3	1
1995	12	10	12	3								5	12	1
1996	12	6	12	6								9	23	2
1997	12	8	12	2								17	17	2
1998	12	9	12	0								18	21	3
1999	12	6	12	3								16	27	3
2000	12	9	12	5					1	1		20	27	4
2001	12	7	12	6					2	2		23	30	4
2002	12	8	12	6					2	1		25	18	7
2003	12	8	12	6					2	1		33	31	8
2004	12	4	12	9					2	0		22	18	7
2005	12	7	12	5					2	1		28	25	8
2006	11	10	12	6	1	1			2	1		36	30	9
2007	11	11	12	9	1	0			4	1	1	27	35	9
2008	11	5	12	6	1	1			3	2	1	30	23	9
2009	12	9	11	4			1	1	3	1	1	32	26	9
2010	12	10	11	7			1	1	2	1		25	19	8
2011	12	11	11	5			1	1	3	1		30	27	9
2012	12	12	11	10			1	1	4	2	2	18	12	10
2013	12	11	11	7			1	1	3	0	2	21	17	8
2014	12	12	11	10			1	1	3	0	1	27	18	9
2015	12	9	11	9			1	1	4	2	2	24	18	10
2016	12	12	11	11			1	1	1	1	0	17	12	10
Totals	**279**	**204**	**274**	**138**	**3**	**2**	**8**	**8**	**43**	**18**	**10**	**504**	**489**	
Success Rate	**73%**		**50%**		**67%**		**100%**		**65%**					

Table 4. Tule Elk Relocated within Initial Boundaries of the La Panza Tule Elk Management Unit (i.e., Boundaries Specified in the 1988 Management Plan), after 1985.

Date	Event	Reference
Oct. 1989	17 cows, 2 sub-adult cows, 10 adult bulls, 6 sub-adult bulls relocated to Avenales Ranch from Tupman.	CDFW database
Sept. 1991	1 adult bull relocated to La Panza from Tupman.	CDFW database
Oct. 1999	5 cows, 2 sub-adult cows, 1 sub-adult bull relocated to Alamo Creek from Concord.	CDFW database
Jan. 2001	5 cows, 5 sub-adult cows, 3 bulls relocated to Alamo Creek from San Luis NWR.	CDFW database
May 2007	12 cows, 1 sub-adult cow, 12 bulls, 1 sub-adult bull relocated to the Chimineas Ranch area from Tupman.	CDFW files
March 2014	6 adult cows, 6 adult bulls relocated to Carrizo Plain Ecological Reserve from San Luis NWR.	CDFW files

Table 5. Tule Elk Relocated to the Northern Portion of the La Panza Tule Elk Management Unit, after 1985.

Date	Event	Reference
July 1990	15 cows, 1 sub-adult cow, 3 adult bulls, 1 sub-adult bull relocated to Varian Ranch (Parkfield) from Concord.	CDFW database
August 1990	3 adult bulls relocated to Varian Ranch from Concord.	CDFW database
Oct. 1990	2 cows, 3 sub-adult cows, 6 sub-adult bulls relocated to Varian Ranch from Grizzly Island.	CDFW database
Sept. 1992	11 cows, 5 sub-adult cows, 2 adult bulls, 2 sub-adult bulls relocated Grigory Ranch (San Ardo, Monterey County) from Grizzly Island.	CDFW database
July 1993	1 adult bull relocated to Varian Ranch from Tupman.	CDFW database
Oct. 1999	2 sub-adult bulls relocated to Priest Valley from Concord.	CDFW database
Jan. 2001	7 cows, 2 sub-adult cows, 2 sub-adult bulls relocated to Priest Valley from San Luis NWR.	CDFW database

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Public Hunting within the La Panza Tule Elk Management Unit, 1994 - 2015. Sample sizes are denoted above bars for each year.

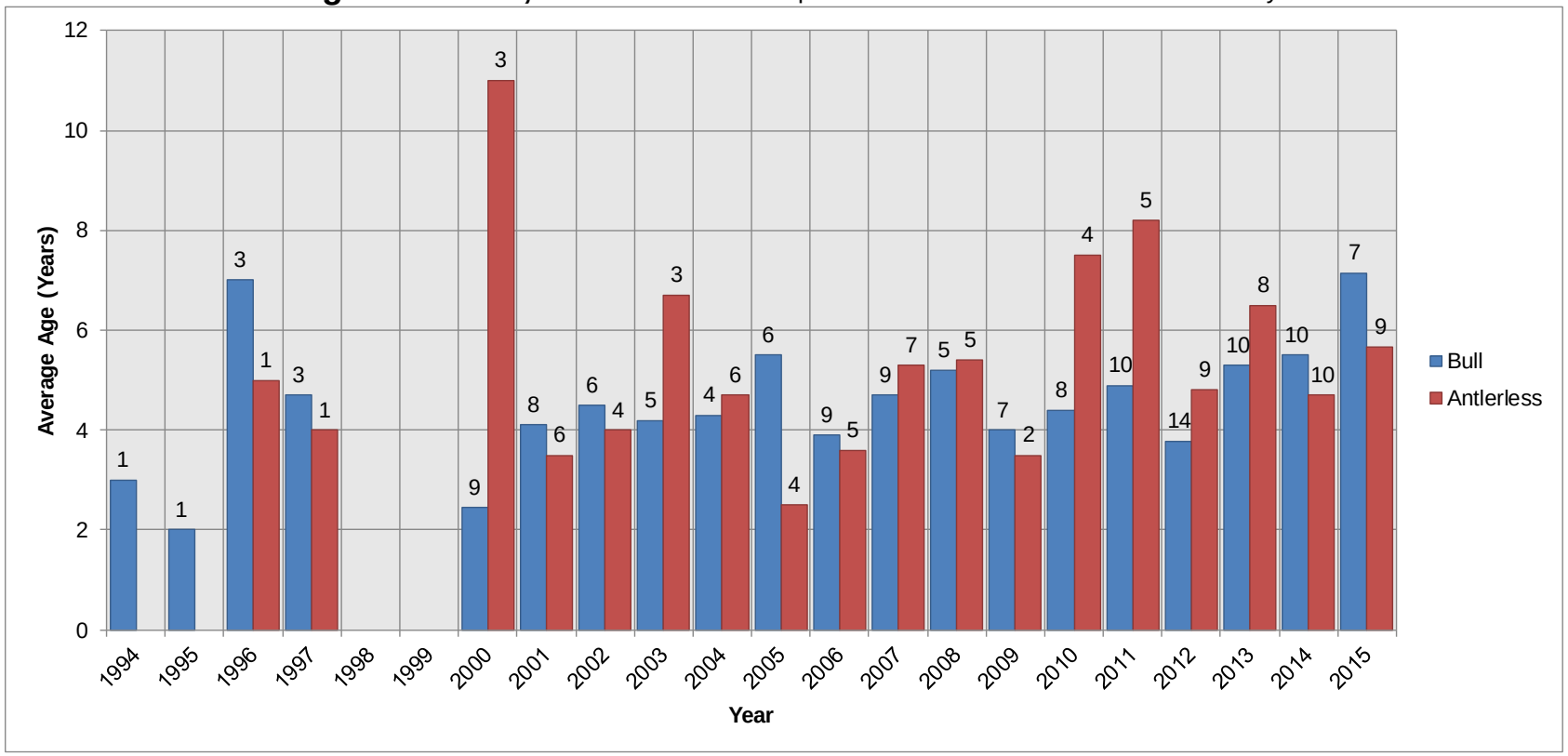


Figure 2. Average Age of Antlered and Antlerless Elk Taken by Hunting through the Private Lands Management Program within the La Panza Tule Elk Management Unit, 1994 - 2015. Sample sizes are denoted above bars for each year.

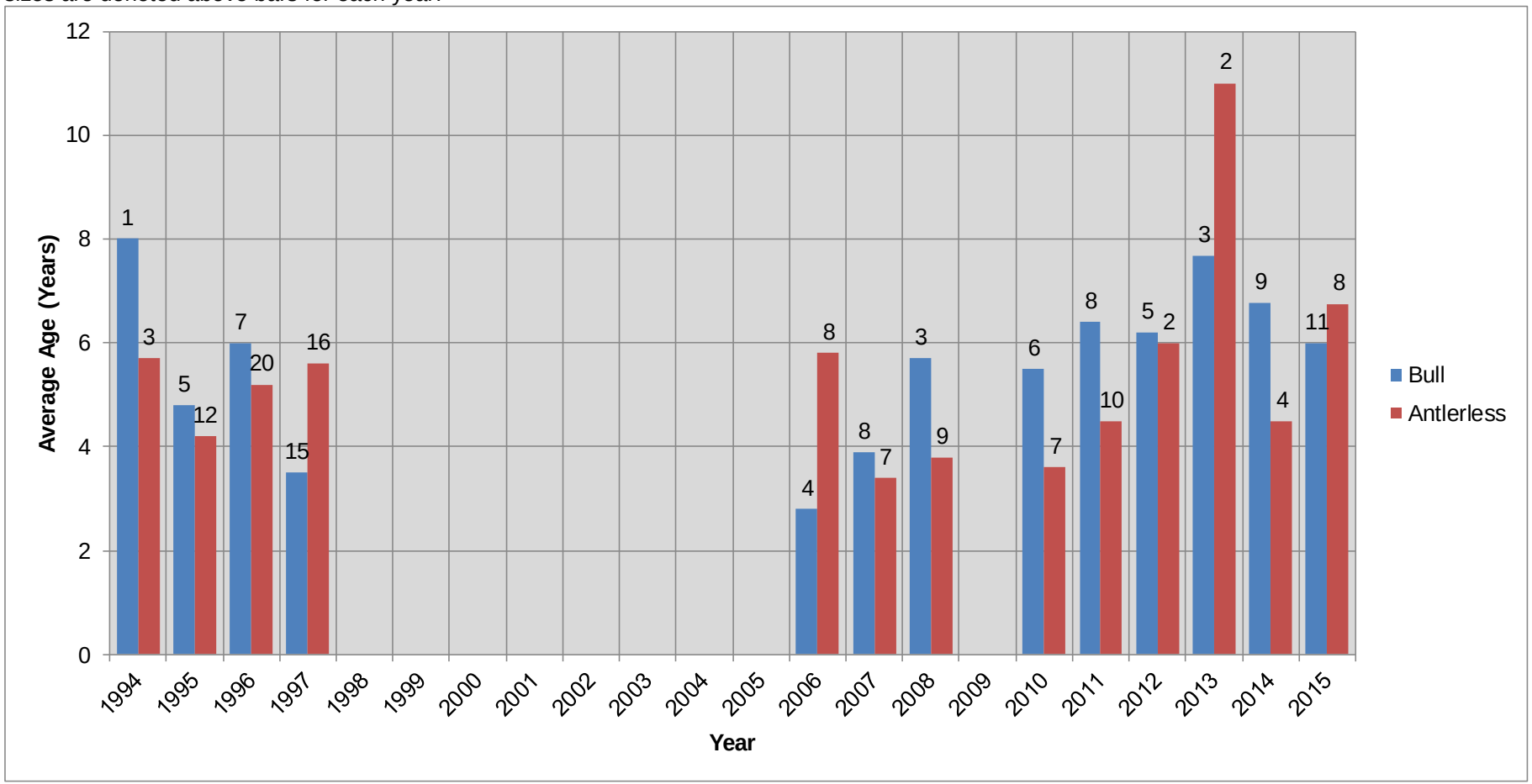
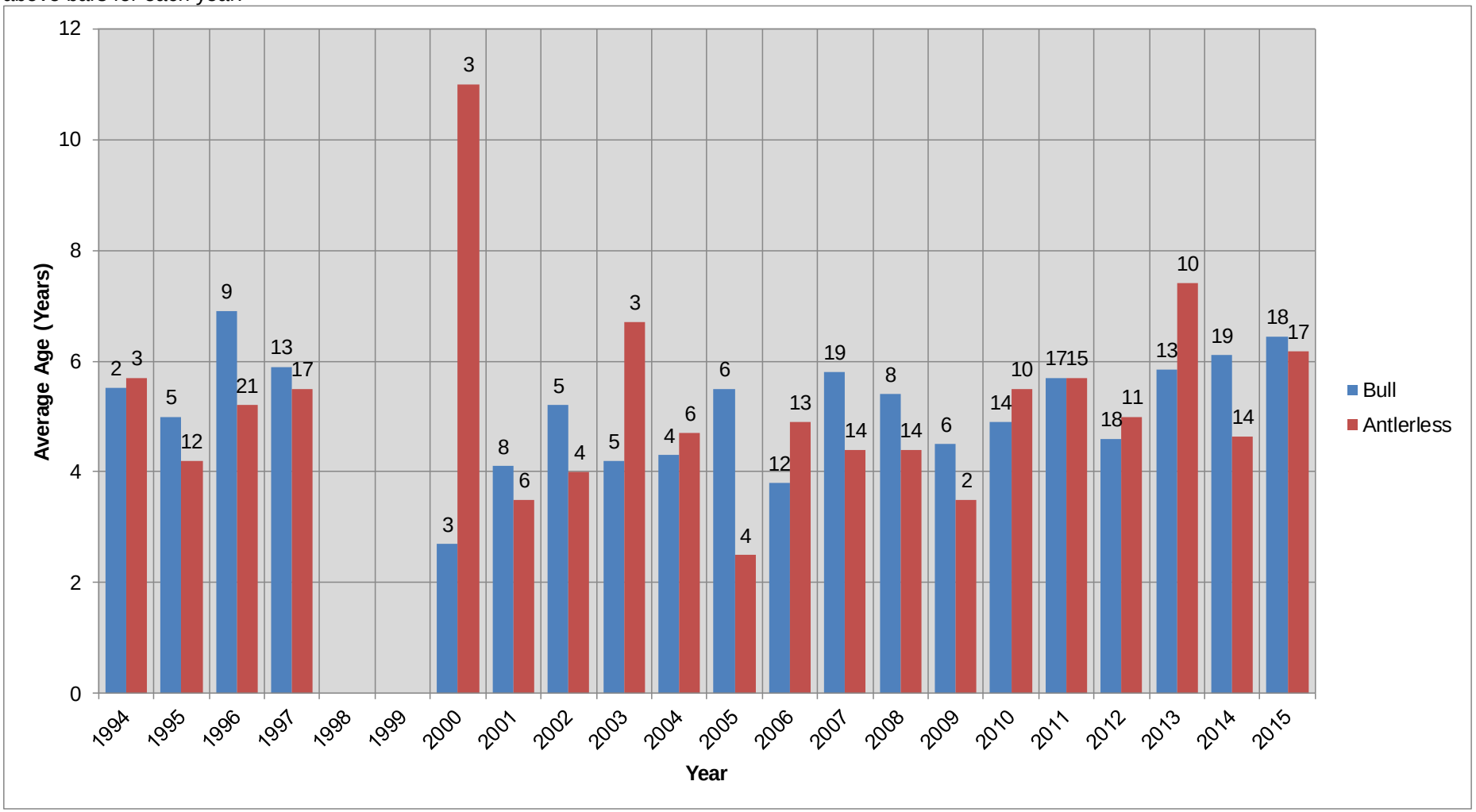
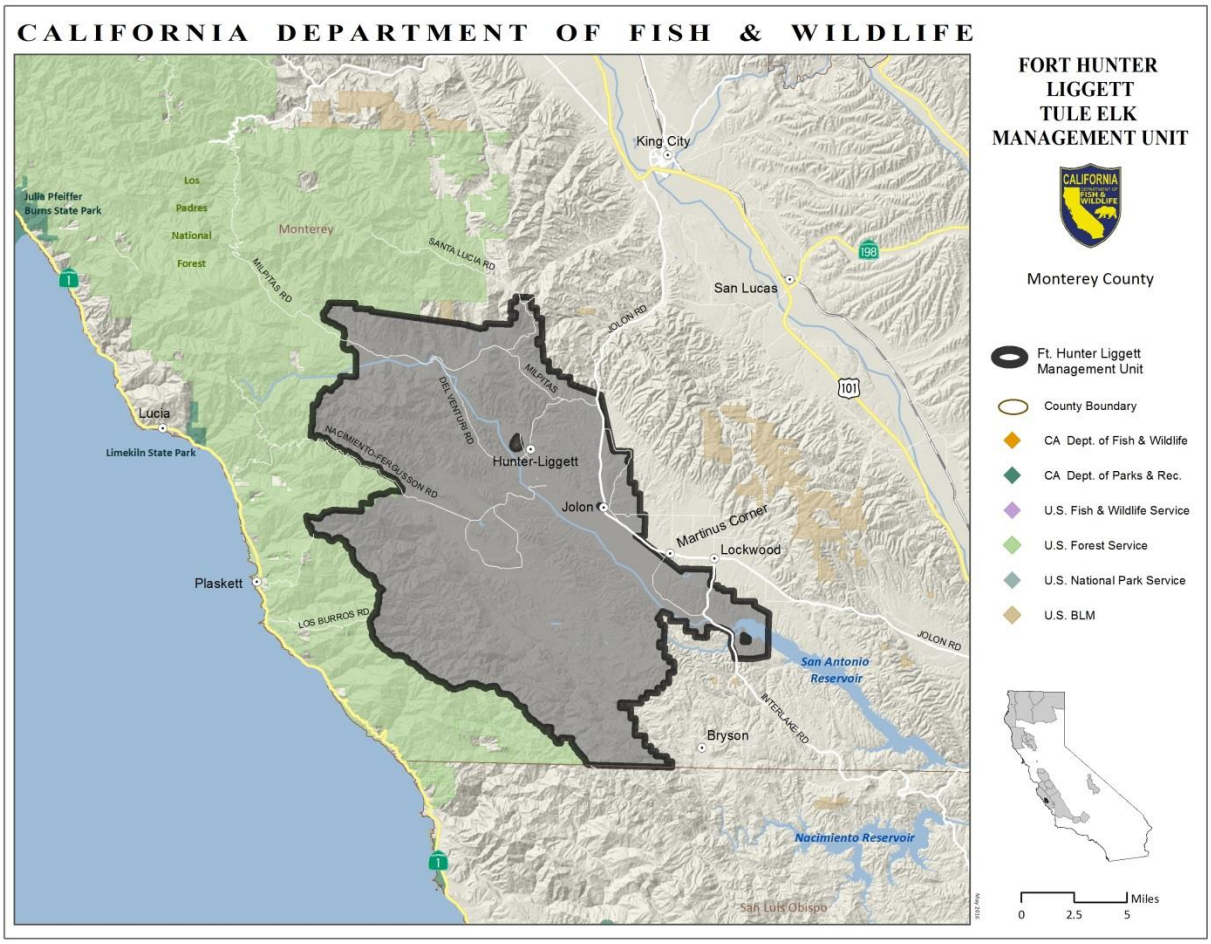


Figure 3. Average Age of Antlered and Antlerless Elk Taken by Public Hunting and the Private Lands Management Program within the La Panza Tule Elk Management Unit, 1994 – 2015. Sample sizes are denoted above bars for each year.



Fort Hunter Liggett Tule Elk Management Unit



Fort Hunter Liggett
Tule Elk Management Unit

Description

The Fort Hunter Liggett Tule Elk Management Unit (Unit) consists of more than 165,000 acres in southern Monterey County managed by the United States Army as a training facility for field maneuvers and exercises involving live ammunition fire. The Unit includes the Fort Hunter Liggett military base (FHL) and extends east beyond the base's boundaries into the Lockwood area and south to Lake San Antonio, where tule elk (*Cervus canadensis nannodes*) distribution has recently expanded.

The Unit occurs in the Santa Lucia Mountains, which are within the Bay Delta and Central Coast Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). This area is historical tule elk range as depicted by McCullough (1969). Vegetation is characterized by oak woodland, riparian, chaparral, and grassland habitats. Topographical features include flat valley floors, gently rolling hills, and steep ridges. Elevation at FHL varies from 500 to 1,500 feet; however, adjacent areas can exceed 3,000 feet. Temperatures can exceed 100° F in summer and decline below freezing in winter. The San Antonio and Nacimiento Rivers bisect the Unit and provide water year-round. Numerous reservoirs and catchments are distributed throughout the Unit.

Although the primary mission of FHL is military training, public hunting may occur on many weekends throughout the year. In cooperation with the California Department of Fish and Wildlife (Department), FHL runs hunting programs and offers annual access passes for a modest fee to hunt elk, deer, wild pigs, waterfowl, and upland game. The base is large enough to accommodate training and public hunting; however, there are constraints on dates/areas open for access. The United States Department of Agriculture Forest Service (USFS; Los Padres National Forest) property is immediately adjacent to the northern, western, and southern boundaries of the base. Tule elk use of USFS and nearby Bureau of Land Management (BLM) land is extremely limited. Much of the private land near the base that supports elk is used for agricultural purposes and generally not accessible to the public.

In addition to hunting, other public uses of elk in the Unit include viewing, nature study and photography. Elk often are near public roads that traverse the FHL interior and can be viewed in fall and winter. Persons with annual passes have opportunities to observe elk within interior portions of the base and away from paved roads.

Elk Distribution and Abundance

In December 1978, 5 bulls, 14 cows, and 3 calves from Tupman Tule Elk State Reserve in Kern County were released to reestablish tule elk at FHL. Numerous poaching incidents occurred during the next several months, and in September of 1979 two more bulls from San Luis Refuge were brought to the base. The population had declined to 4 cows by 1981. In December 1981, 5 bulls, 14 cows, and 7 calves from the Owens Valley were brought in to augment the initial reintroduction effort (Willison 1986).

Tule elk are now well established at the base. Elk have dispersed in recent years into private land east of the base near Lockwood, and south towards Lake San Antonio, where agricultural and private property conflicts have occurred. FHL personnel conduct ground surveys to monitor age and sex ratios, and minimum population levels (Table 1). The current population estimate for the Unit is 250 animals.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that includes hunting and viewing; and 3) alleviate human-elk conflicts and elk depredation complaints. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is stable and has not reached the upper population target identified in Objective 1.5. The population on FHL decreased during the drought years (2012-2017). This decrease is attributed to elk leaving FHL due to changing habitat conditions and not a decrease in overall elk numbers. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Population management for this Unit involves efforts to increase elk numbers where suitable, while working to stabilize elk numbers in conflict areas adjacent to FHL. Because conflicts on adjacent agricultural land are a concern, regulated hunting will be used to promote population growth towards the upper population objective while alleviating conflicts on adjacent private land.

Development, approval, and initiation/completion of specific habitat improvement projects are at the discretion of the base. Department personnel provide expertise, including specific recommendations to alleviate agricultural and private property

conflicts involving elk. Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with Fort Hunter Liggett base personnel.

Objective 1.1. Continue and complete projects to determine population abundance, distribution, habitat use, and demographics by 2025, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.2
Coordinate with FHL to conduct annual population surveys and collect distribution and composition data in an effort to improve management decisions that would benefit elk. Expected completion: 2020.

Action 1.1.3
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations to pre-2012 levels by 2028.

Action 1.2.1
Coordinate with FHL to identify management actions to increase elk numbers. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitats by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2025.

Action 1.3.2
Meet annually with FHL to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Coordinate with FHL to modify livestock grazing practices to improve water infiltration, retention, and the condition of riparian areas. Ongoing.

Action 1.3.4
Participate in planning efforts that identify potential impacts and make recommendations that benefit elk and elk habitats. Ongoing.

Action 1.3.5
Coordinate with FHL to eradicate noxious weeds and undesirable invasive plants, establish additional water sources, and use prescribed fire to enhance elk habitat. Ongoing.

Objective 1.4. Determine genetic diversity of the population by 2023.

Action 1.4.1
Distribute DNA collection kits to elk hunters and FHL Environmental Resources personnel for submittal of DNA samples. Ongoing.

Objective 1.5. Maintain a population of 200-450 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.5.1
Provide bull and antlerless hunting opportunities at levels that allow for expansion of the elk population in consideration of adjacent private property conflicts. Ongoing.

Action 1.5.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study. Viewing opportunities are limited because access is prohibited in some areas where elk use is greatest.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting

regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

If the elk population for the Unit approaches or exceeds the established upper limit (450 elk), the Department may increase hunting opportunities, especially if depredation and/or human conflicts escalate.

Objective 2.1. Maintain or increase civilian and military elk hunting opportunities compatible with population objectives.

Action 2.1.1
Continue to provide recreational hunting opportunities to military and civilian personnel, compatible with the military base's primary objective of military training. Ongoing.

Action 2.1.2
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 2.1.3
Evaluate incorporating the area within a larger public elk hunt zone (Central Coast). Expected completion: 2021.

Action 2.1.4
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Expected completion: 2021.

Objective 2.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.2.1
Work with FHL and non-governmental organizations (NGOs) to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population increases within the Unit, additional actions to control population numbers may become necessary. Human-elk conflicts are mainly limited to private property adjacent to FHL, but management actions within the zone will have direct impacts to adjacent properties. Regulated hunting provides valid recreational

opportunities and can assist landowners with human-elk conflicts. Annual harvests can be adjusted to address human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population.

Damage to agricultural land has occurred outside the base boundary. In 2003, the Department began to receive complaints regarding damage to private property leased for agricultural crop production (watermelon, tomatoes, and green onions) adjacent to the base. Elk consumed and damaged melons; additionally, they damaged the drip irrigation system. The landowner received a few depredation permits which did not alleviate or resolve the damage. Department staff worked with the base utilizing hunting regulations to address the issue. The Department also worked with the landowner/lessee to build a small demonstration electric fence along the base boundary which protected crops. The landowner also moved crops to plant melons farther away from the base boundary. Damage conflicts appear to have subsided and the landowner/lessee has not contacted the Department for several years.

Elk have recently dispersed into the Lockwood Valley and damaged private property, including residential yards. More people are moving to the valley and agricultural use is expanding (particularly with planting of vineyards); thus, land use conflicts are an ongoing concern. Complaints have increased as some elk have left FHL and established on adjacent private property.

The Department will emphasize use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems.

Objective 3.1. Reduce reports of human-elk conflicts on adjacent private property by at least 25% by 2025.

Action 3.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Use regulated hunting to maintain population numbers below the maximum objective and reduce human-elk conflicts on adjacent properties. Ongoing.

Action 3.1.3
Coordinate with FHL personnel to identify strategies to reduce depredation conflicts on agricultural land adjacent to the base. Utilize livestock grazing to discourage elk from perimeter areas of the base adjacent to agricultural land where depredation conflicts have occurred. Expected completion: 2020.

Action 3.1.4
Coordinate with FHL to evaluate the feasibility of establishing a public hunt zone that surrounds the Fort Hunter Liggett base so that hunting on private land can be used to reduce depredation conflicts and provide hunter opportunity. Expected completion: 2020.

Action 3.1.5
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.6
Document and continue to respond to human-elk conflicts and provide the reporting party a list of techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.7
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.8
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Tule elk were reintroduced to FHL over 35 years ago and the population has grown significantly. The Unit is isolated from other tule elk (although releases occurred near Parkfield and San Ardo during the late 1980s and early 1990s). Elk within the Unit show no sign of reproductive suppression. Periodic and opportunistic translocation of individuals or small groups into the Unit might improve genetic diversity, if determined to be necessary. However, moving additional elk into the Unit should be deferred until private property depredation conflicts adjacent to FHL are resolved.

Summary of Annual Harvests

Current harvest strategies involve issuing bull, antlerless, and either-sex tags to apprentice hunters, archers, muzzleloaders, and general methods hunters. Additionally, since 2010, FHL has made a military tag available to conservation organizations for fund-raising purposes. Resulting revenue has been used for habitat improvement projects on the base.

Tag quotas and harvests from 1996-2016 (Table 2) indicate hunter success has been high. Tule elk population numbers continued to grow within the Unit through 2003 (Table 1), until depredation conflicts developed on adjacent private agricultural land. In an effort to reduce depredation conflicts and manage the population below the maximum desired level, archery tags were issued beginning in 2004, and bull and antlerless elk tag quotas increased significantly from 2004-2013 (Table 2; additional tags have since been issued to apprentice and muzzleloader hunters). Annual harvest increased until 2011 and has since declined; harvest has varied between five and 11% of the population size.

Access for recreational hunting and fishing is secondary to military training and the Commanding Officer may impose restrictions on dates or areas open to the public. FHL's 2001 and 2016 elk seasons were cancelled by the Commanding Officer. Other restrictions occurred periodically and affected hunter opportunities and resulting harvest.

Mean ages of antlered (bulls) and antlerless elk taken within the Unit since 1996 by regulated hunting are listed in Figure 1. Mean age of harvested bulls ranged from 3.7-5.9 years, whereas antlerless elk ranged from 2.8-7.0 years old.

Unit Highlights

Tule elk have been reestablished within the Unit for over 35 years. While liberal tag quotas since 2004 may have temporarily curtailed population growth, tule elk are doing well within the base boundaries. Agricultural conflicts adjacent to the base are an ongoing management concern.

The Sikes Act mandates cooperation between the United States Department of Defense (DOD) and State agencies in planning, maintaining, and developing fish and wildlife resources on military reservations. Similarly, California's policy to encourage sound management of fish and wildlife resources on lands administered by DOD is specified in Section 3450 of the Fish and Game Code (FGC § 3450). The Department, FHL personnel, and the academic community have collaborated to develop plans and programs to manage tule elk on the base. Below is a partial listing of these activities:

- In 1979, a management plan for Fort Hunter Liggett was prepared which specified a maximum population level of 350-400 elk.

- Fowler (1985) reviewed the status of tule elk in California and recommended a population level of 500-650 for FHL. Fowler assumed that some level of range expansion would occur beyond the base boundaries.

- Hanson and Willison (1982) and Willison (1986) reported on efforts to reestablish tule elk at FHL.

A partial listing of these and other studies submitted to the Department includes the following:

Unit Specific Research

Fowler, G.S. 1985. Tule elk in California: history, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California, Berkeley, USA.

Hanson, M.T., and J.M. Willison. 1982. Habitat utilization and calving results of tule elk at Fort Hunter Liggett. Unpublished report submitted to California Department of Fish and Game by California Polytechnic State University San Luis Obispo, Natural Resources Management Department, San Luis Obispo, USA.

Willison, J.M. 1986. The tule elk at Fort Hunter Liggett. Thesis, California Polytechnic State University, San Luis Obispo, USA.

Literature Cited:

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, USA.

FGC § 3450.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Willison, J.M. 1986. The tule elk at Fort Hunter Liggett. Thesis, California Polytechnic State University, San Luis Obispo, USA.

Data Tables/Figures

Table 1. Fort Hunter Liggett Tule Elk Management Unit, Population and Survey Results.

Date	Number of Elk Counted				
Month, Year	Bulls	Cows	Calves	Unknown	Total
Jan. 1979*	4	14	3	0	**21**
Mar. 1980*					**16**
Mar. 1981*	2	17		0	**19**
Mar. 1982*					**29**
Nov. 1983**	8	23	9	0	**40**
Oct. 1985*					**50-75**
Dec. 1988*					**95-135**
Dec. 1990*					**125-175**
1995	58	78	32	0	**168**
Oct. 1996	32	51	10	0	**93**
Oct. 1997	18	98	26	0	**142**
1998	42	121	27	0	**190**
Jan. 1999	41	116	29	0	**186**
Sept. 2000	29	69	35	0	**133**
Oct. 2001	79	142	81	0	**302**
2002	58	125	42	0	**225**
2003	24	144	50	0	**218**
2004	57	130	33	0	**220**
2005	60	142	43	0	**245**
2006	45	158	66	0	**269**
2007	50	131	42	0	**223**
2008	137	115	30	0	**282**
2009	94	127	42	0	**263**
2010	28	104	60	0	**192**
2011	109	130	56	0	**295**
2012	51	118	53	0	**222**
2013	43	135	57	0	**235**
Jan. 2014	72	122	32	0	**226**
April 2014	41	92	1	0	**134**
Jan. 2015	112	98	37	0	**247**
May 2015	106	116	50	0	**272**
July 2016	37	64	22	0	**123**
Oct. 2016	105	105	38	0	**248**
Aug. 2017	31	98	37	0	**166**

* From: The Tule Elk in California. Annual Reports fo Congress Prepared by the Bureau of Land Management (volumes 1-10).

** From Willison, 1986

Sources: FHL Letter to CDFW

Table 2. Fort Hunter Liggett Tule Elk Management Unit, Total Tag Quotas and Harvests, 1996-2016.

Year	Bull		Antlerless		Archery Either-Sex			Archery Antlerless		Apprentice Bull		Apprentice Antlerless		Muzzleloader Bull	
	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1996	10	8	20	16											
1997	10	10	20	15											
1998	10	8	20	8											
1999	10	10	20	12											
2000	14	13	20	9											
2001	14	0	20	0											
2002	14	10	20	12											
2003	14	13	20	15											
2004	14	4	30	17	6	4		10	5						
2005	14	4	30	13	6	5	1	10	3						
2006	12	9	29	16	6	5		10	2	2	2	1	1		
2007	14	9	30	12	6	4		10	2	2	1	4	1		
2008	14	12	30	10	6	6		10	1	2	2	4	2		
2009	14	11	30	22	6	4		10	3	2	1	4	4		
2010*	16	15	30	28	6	4		10	1	2	2	4	3	6	6
2011*	16	16	30	22	6	6		10	1	2	2	4	3	6	6
2012**	16	14	31	18	6	5		10	2	2	2	4	3	6	1
2013	12	12	23	17	6	3		10	2	2	2	4	4	6	2
2014	10	8	17	10	4	0		8	4	2	2	2	1	0	0
2015	8	6	17	10	4	3		8	1	1	1	1	0	0	0
2016***															
Totals	**256**	**192**	**487**	**282**	**68**	**49**	**1**	**116**	**27**	**19**	**17**	**32**	**22**	**24**	**15**
Success Rate	**75%**		**58%**		**74%**			**23%**		**89%**		**69%**		**63%**	

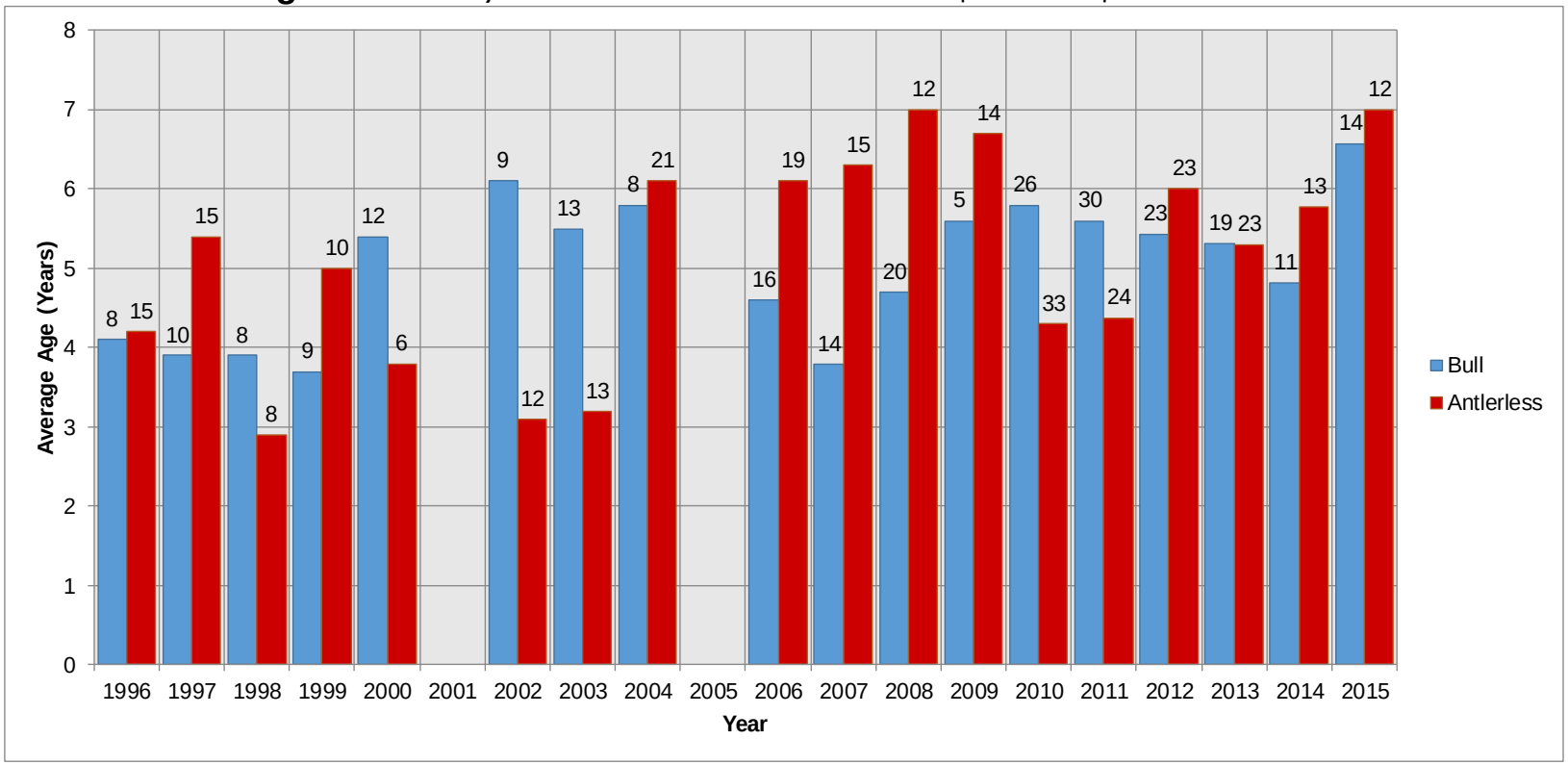
Tags Issued include both military and civilian tags.

* Beginning in 2010 two additional bull tags were issued to the Military (no civilian counterpart).

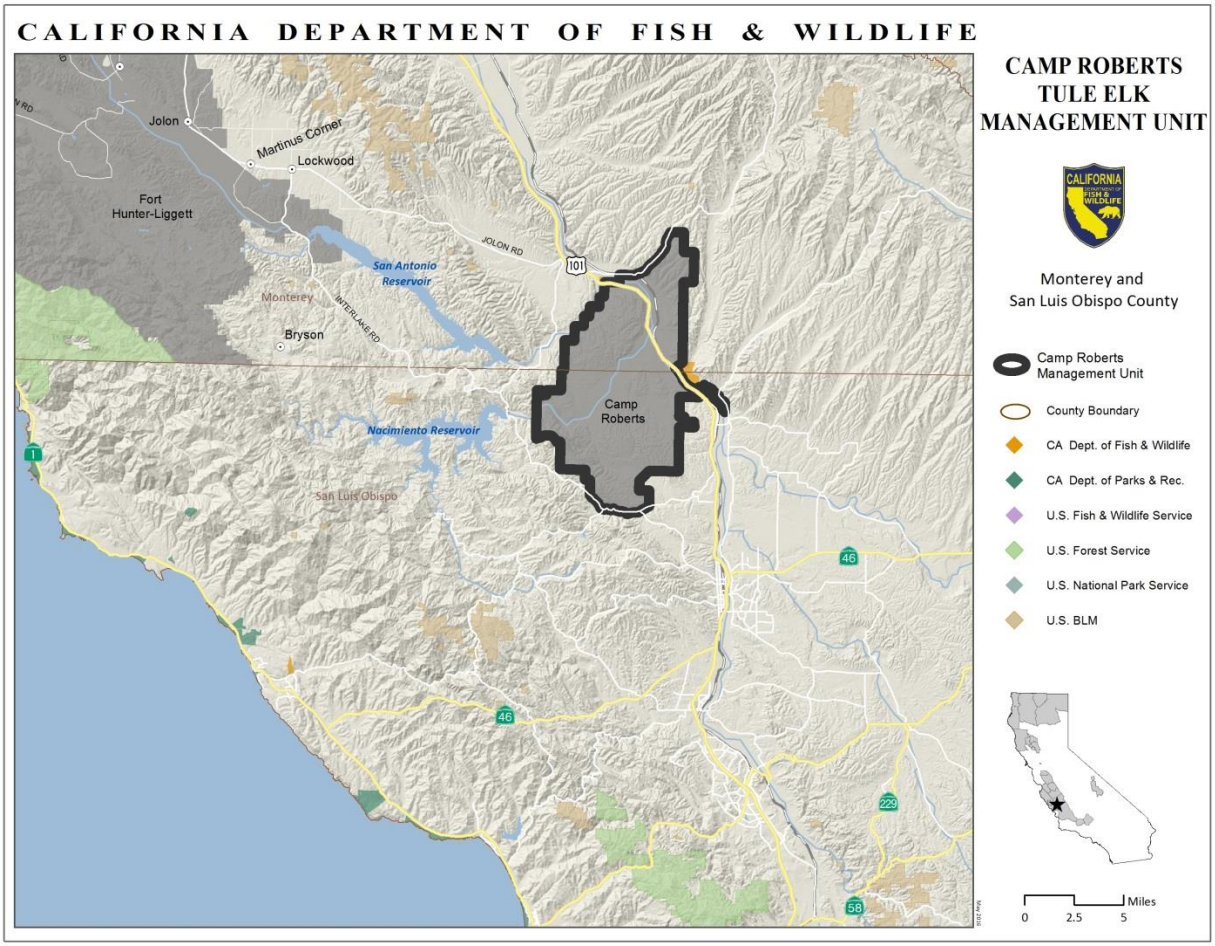
** In 2012, two additional bull and one antlerless tags were issued to the Military (no civilian counterpart).

*** In 2016, no elk hunts occurred at Fort Hunter Ligett due to increased military training.

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting within the Fort Hunter Liggett Tule Elk Management Unit, 1996-2015. Numbers above bars represent sample size.



Camp Roberts Tule Elk Management Unit



Camp Roberts
Tule Elk Management Unit

Description

The Camp Roberts Tule Elk Management Unit (Unit) includes portions of southern Monterey and northern San Luis Obispo counties, and is centered approximately 5 miles east of San Antonio Reservoir. The Unit boundaries correspond with boundaries of the Camp Roberts Army National Guard Base. The Unit is within the Bay Delta and Central Coast Province, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015), and consists primarily of oak woodlands and grasslands. The Nacimiento, San Antonio and Salinas rivers have well developed gallery oak and/or sycamore riparian corridors. Climate is Mediterranean; elevations range from 600 to 1800 feet. The area spans approximately 43,000 acres within historical tule elk (*Cervus canadensis nannodes*) range as depicted by McCullough (1969).

Camp Roberts is federal property used for military training and weapons experimentation. The public has access to Camp Roberts through a public hunting and fishing program that the California Department of Fish and Wildlife (Department) administered for over 25 years until 2011 (base personnel currently administer the program). County park land around both the San Antonio and Nacimiento reservoirs offers boating, fishing and camping, but not hunting. General public access to Camp Roberts specifically for nature study is not allowed; however, participants in the public hunting and fishing program are afforded the opportunity to view and photograph tule elk and other non-consumptive uses.

Elk Distribution and Abundance

The Camp Roberts herd was established in 1978 with 21 elk from Tupman Tule Elk State Reserve. Thirteen more elk from Tupman were released in 1983. Several animals from each release were fitted with radio transmitters and monitored. A total of 88 elk were observed during a helicopter survey of Camp Roberts in 1988. From 1988-1990, it appears that 60-65 elk dispersed to the north from Camp Roberts (California Department of Fish and Game 1991). Additionally, in 1991, the Department released 13 tule elk from Grizzly Island on a private ranch near San Ardo in southern Monterey County. In 1992, an additional 20 were released at the same location (California Department of Fish and Game 1995). Whether any of these animals or their progeny dispersed into the Unit is unknown. It is also unknown whether additional elk have dispersed from the Unit since 1990. Elk leave the base boundaries on occasion and 10-40 elk have been observed on a regular basis northward to the Nacimiento Valley.

The National Guard Environmental office periodically conducts elk surveys of Camp Roberts. Department personnel observe elk within the Unit in the course of conducting other activities. Annual surveys of the Unit have not occurred, but 136 elk were counted (including 28 adult bulls) in January 2014 and over 500 elk were counted on a coordinated ground survey in 2015. It is likely that some elk were double counted in 2015. The current population estimate for the Unit is 300 animals

In 2015 and 2016, some bull elk were found dead (cause undetermined) in the Unit. Illegal take (deliberate and unintentional) was also documented during deer season. Military weapons firing/artillery explosions are possible mortality factors (California Department of Fish and Game 1988).

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) develop opportunities for public use and enjoyment of elk that includes hunting and enhances viewing opportunities; and 3) alleviate human-elk conflicts and elk depredation complaints. Specific objectives and actions to assist with achievement of each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population within this Unit is increasing but has not reached the upper population target identified in Objective 1.5. Collecting elk population and habitat data will allow the Department to track trends through time and measure the success of enhancing elk and elk habitat.

Population management for this Unit involves efforts to increase elk numbers, where suitable, while working to stabilize elk numbers in conflict areas adjacent to the Unit. Improving elk habitat is important. The base allowed sheep grazing in the past, which may have adversely impacted elk and exacerbated private property conflicts during a dry year. In addition, there are many reservoirs on the base in need of repair so that they can hold water later into summer. Department comments on the base's Integrated Natural Resource Management Plan have urged development of residual dry matter standards related to grazing (California Army National Guard 2014). Camp Roberts is working to develop such standards.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with Camp Roberts Military personnel.

Development, approval, initiation, and completion of specific habitat improvement projects are at the discretion of the base. However, Department personnel can provide expertise and assist the base as necessary and the Department should be prepared to provide specific recommendations to alleviate agricultural and private property conflicts involving elk.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with information to make adaptive management decisions.

Action 1.1.1
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, and assist with evaluating harvest strategies. Expected completion: 2021.

Action 1.1.2
Coordinate with Camp Roberts to establish consistent annual surveys in an effort to inform management decisions that would benefit elk. Expected completion: 2020.

Action 1.1.3
Develop innovative technologies to estimate population parameters, such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations to 10% by 2028.

Action 1.2.1
Coordinate with Camp Roberts to identify management options to increase elk numbers. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2025.

Action 1.3.2
Meet annually with Camp Roberts to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.4
Coordinate with Camp Roberts to develop grazing standards such as residual dry matter standards. Ongoing.

Action 1.3.5
Coordinate with Camp Roberts to improve the condition of water sources. Ongoing.

Objective 1.4. Determine genetic diversity of the population by 2023.

Action 1.4.1
Distribute DNA collection kits to Camp Roberts Environmental Resources personnel for submittal of DNA samples. Ongoing.

Objective 1.5. Maintain a population of 200-450 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.5.1
Implement bull and antlerless hunting opportunities at levels that allow for expansion of the elk population in consideration of adjacent private property conflicts. Ongoing.

Action 1.5.2
Annually review data and adjust population objectives, as needed, as more information is collected through monitoring, management, and research. Ongoing.

Goal 2. Develop opportunities for public use and enjoyment of elk that include hunting and enhances public viewing opportunities.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department will recommend establishing a hunt zone in this Unit to manage population numbers and provide opportunities for public use. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success and, over time, elk population numbers and age/sex compositions within the Unit. The quality and quantity of elk demographic data, landowner concerns regarding human-elk conflicts, and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take.

Combined with establishing a public hunt zone for the Unit, another potential population management strategy for the future involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to or through their land for public recreational use and enjoyment of wildlife. SHARE is funded with application fees for access permits.

Objective 2.1. Establish elk hunting opportunities that are compatible with population objectives by 2020.

Action 2.1.1
Complete a new elk hunting environmental document that will analyze hunting opportunities. Expected completion: 2020.

Action 2.1.2
Determine recommended quotas that are compatible with population objectives and provide opportunities to the public. Expected completion: 2020.

Objective 2.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.2.1
Work with Camp Roberts and non-governmental organizations (NGOs) to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population continues to increase within the Unit, additional actions to control population numbers may become necessary. Human-elk conflicts are mainly limited to private property adjacent to the Unit but management actions within the zone will have direct impacts to adjacent properties. Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. A hunting program will stabilize population numbers over the Unit (consistent with population objectives) and limit adjacent human-elk conflicts. Annual harvests can minimize conflicts. Where substantial conflicts occur, elk population control, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population.

Damage to agricultural land has occurred on a regular basis outside the base boundary, particularly near Nacimiento Lake Drive where elk have damaged alfalfa, barley, grapes, and row crops. Periodic complaints also have been received from livestock operators along the northern and southern boundaries of the base. While fencing of row crops has reduced damage, occasional incursions involving wild pigs and elk continue.

Area landowners receive information on how to construct elk crossings to reduce fence damage. Other potential management strategies to alleviate depredation on private agricultural land near Camp Roberts include developing additional or improving existing water sources, establishing irrigated pastures to entice elk away from agricultural areas, and implementation of regulated hunting to manage/reduce population numbers.

However, property damage and agricultural conflicts could escalate if elk distribution expands or population numbers increase. Controlling population numbers and land use conflicts with regulated hunting may become more challenging because of the prevalence of adjacent private land. The SHARE program was discussed previously as a potential population management strategy that can improve public access to private (or landlocked public) land near the Camp Roberts base. The SHARE program may also assist in controlling elk population numbers and managing damage or land use conflicts that involve elk on private land.

The Department will emphasize use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems.

Objective 3.1. Reduce reports of human-elk conflicts on adjacent private property by at least 25% by 2025.

Action 3.1.1
Map areas of high human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation.
Ongoing.

Herd Viability

The Camp Roberts tule elk herd has persisted for 35 years, initially at a relatively low population level, followed by a substantial increase within the last several years. There is potential for interchange of individuals between Camp Roberts and other populations in south Monterey and/or northern San Luis Obispo counties. Although the herd is viable, it has been relatively isolated from adjacent units and might benefit from periodic translocation of individuals into the Unit on an opportunistic basis. Reports from adjoining property owners indicate that elk are leaving the base on a regular basis.

Summary of Annual Harvests

Adjacent landowners to the Unit have expressed interest to hunt tule elk through the Private Lands Management (PLM) program. A portion of the elk utilizing adjacent properties may be from the core population at Camp Roberts. Camp Roberts is working with the Department to establish a general draw elk zone for public hunting within the base boundaries.

Unit Highlights

Cooperation and support of private landowners is critical to maintaining the Camp Roberts herd, as is collaboration with Camp Roberts base personnel. The Department has collaborated with private landowners and the academic community to develop plans and programs to manage tule elk on the base. Below is a partial listing of management activities undertaken and accomplishments within the Unit:

- Fowler (1985) reviewed the status of tule elk in California, including those at Camp Roberts.

- In 1987, the Department planted grasses and clovers on five hectares (13 acres) along the Naciemiento River near the southern boundary of the impact area, in an effort to reduce damage to adjacent private agricultural property. Occasional guzzler repair has been conducted (there are 6-8 guzzlers) on the base.

- In 1988, the Camp Roberts Tule Elk Management Unit Management Plan was written.

A partial listing of products from these and other studies submitted to the Department includes the following:

Unit Specific Research

California Department of Fish and Game. 1988. Camp Roberts tule elk management unit management plan. Unpublished report, California Department of Fish and Game, Sacramento, USA.

Fowler, G.S. 1985. Tule elk in California: history, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California, Berkeley, USA.

Literature Cited:

California Army National Guard. 2014. Integrated Natural Resources Management Plan Update. Planning Period Fiscal year 2014-2019, Final Check Copy. Camp Roberts Training Center. Sacramento, California. February.

California Department of Fish and Game. 1988. Camp Roberts tule elk management unit management plan. Unpublished report, California Department of Fish and Game, Sacramento, USA.

California Department of Fish and Game. 1991. Tule elk in California: a report to the legislature. Unpublished report. California Department of Fish and Game, Sacramento, USA.

California Department of Fish and Game. 1995. Report to the legislature regarding tule elk. Unpublished report. California Department of Fish and Game, Sacramento, USA.

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

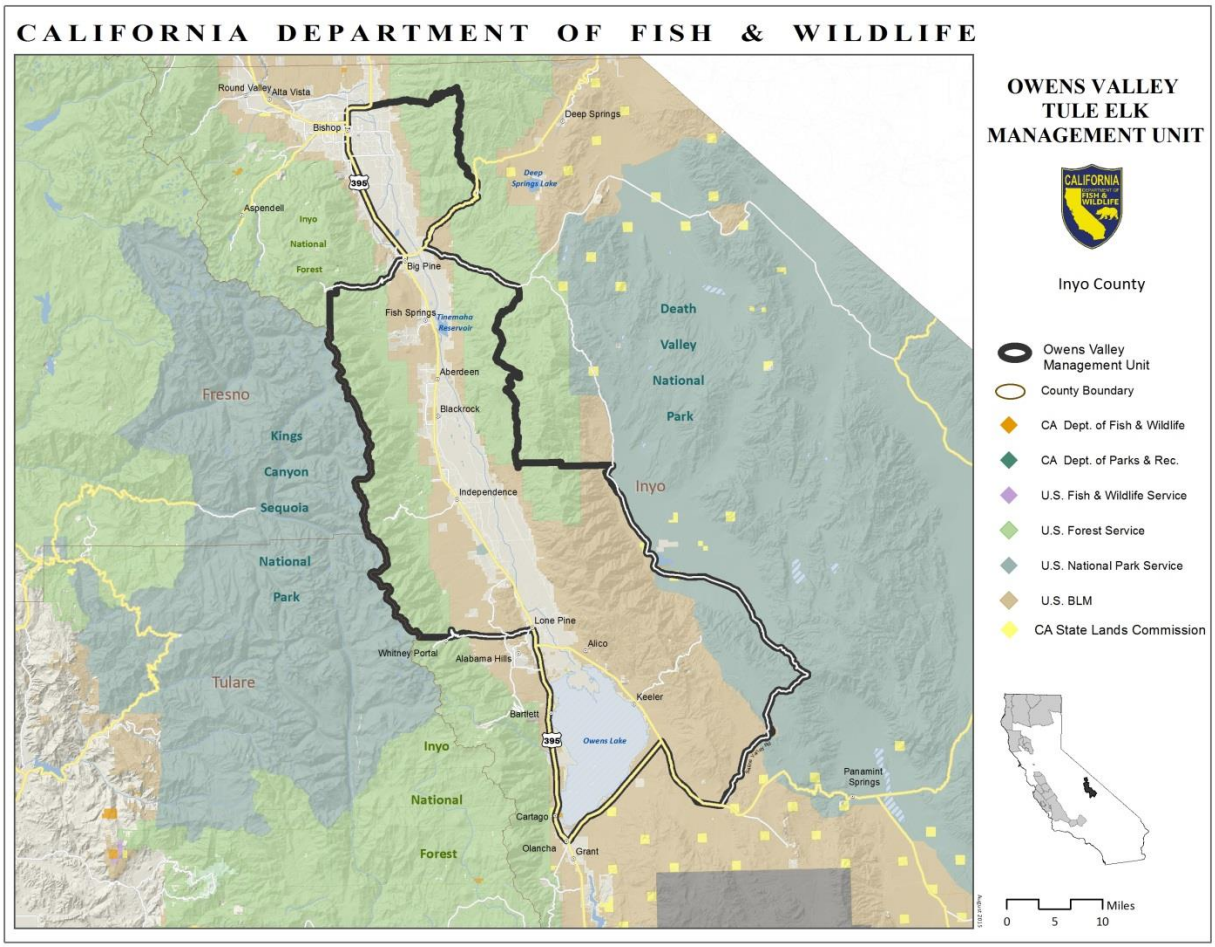
Data Tables/Figures

Table 1. Camp Roberts Tule Elk Management Unit, Population and Survey Results.

Date	Number of Elk Counted					Notes
Month, Year	Bulls	Cows	Calves	Unknown	Total	
Dec. 1978	6	11	4		**21**	Source: The Tule Elk in California, Vol 3
Jan. 1979	5	11	3		**19**	Source: The Tule Elk in California, Vol 3
Jan. 1980	2	8	4		**14**	Source: The Tule Elk in California, Vol 4
Dec. 1980	2	11	4		**17**	Source: The Tule Elk in California, Vol 5
Mar. 1982				19	**19**	Source: The Tule Elk in California, Vol 6
Mar. 1983	3	12	9		**24**	Source: The Tule Elk in California, Vol 7
Nov. 1983						13 added from Tupman
Oct. 1985	12	12	9		**33**	Source: The Tule Elk in California, Vol 8
1987					**88**	Source: Camp Roberts Annual Report
Dec. 1988				85-90	**85-90**	Source: The Tule Elk in California, Vol 9
Dec. 1990				90-100	**90-100**	Source: The Tule Elk in California, Vol 10
July. 1996	18	12	3		**33**	Source: Camp Roberts Annual Report
June 1999	7	32	3		**42**	Source: Camp Roberts Annual Report
2000	1		23		**24**	Source: Camp Roberts Annual Report
2001	6	37	10		**53**	Source: Camp Roberts Annual Report
2004				31	**31**	Source: Camp Roberts Annual Report
Jan. 2014	28				**~136**	Helicopter survey by Camp Roberts staff
Jan. 2015	62	229	9	224	**524**	Drive count cunducted by Camp Roberts staff

Sources: The Tule Elk in California. Annual Reports to Congress by BLM (volumes 3-10).
Summary of Camp Roberts Hunting and Fishing Program Annual Reports, 1981-2011.
** Jan. 17 helicopter survey by Camp Roberts Staff.

Owens Valley Tule Elk Management Unit



Owens Valley
Tule Elk Management Unit

Description

The Owens Valley Tule Elk Management Unit (Unit) in Inyo County is oriented along a north-south axis between the Sierra Nevada Mountains and the White/Inyo Mountains. Elevation of the 75-mile long valley floor varies from 3,600 feet at Owens Lake to 4,200 feet at the town of Bishop. The semi-arid Owens Valley is within the Sierra rain shadow; precipitation averages about five inches annually. Summer temperatures exceed 100º F; winter lows can reach 0º F. US Highway 395 is a primary thoroughfare along the west side of the valley.

The Unit is within the Central Valley and Sierra Nevada, and the Deserts Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015) and outside historical tule elk (*Cervus canadensis nannodes*) range, as depicted by McCullough (1969). Vegetation includes Great Basin and Mohave Desert shrub communities (McCullough 1969). Saltbush (*Atriplex* spp.), sagebrush (*Artemisia* spp.) and rabbitbrush (*Chrysothamnus nauseosum*) dominate the valley uplands, while greasewood (*Sarcobatus vermiculatus*), saltgrass (*Distichlis spicata*), and shadescale (*Atriplex confertifolia*) dominate the lowlands (Bleich et al. 2001). The Owens River flows south through the valley, creating riparian areas of willow (*Salix* spp.), cottonwood (*Populus fremontii*), and cattail (*Typha domingensis*) marshes. Bull tule elk are occasionally seen in the Sierra foothills west of the valley where dominant shrubs include Bitterbrush (*Purshia* spp.), mountain mahogany (*Cercocarpus ledifolius*), and Ceanothus (*Ceanothus* spp.).

The Unit contains approximately 915,000 acres. Public agencies administer over 95% of the land that supports elk and access is very good. The Los Angeles Department of Water and Power (DWP) acquired bottomlands along the Owens River in the early 1900s for water rights. The United States Department of Agriculture Forest Service (USFS) administers the foothills of the Sierra Nevada, White, and Inyo mountains, whereas the United States Department of Interior Bureau of Land Management (BLM; Bishop Field Office), administers most of the remaining land between DWP and USFS land. Land uses include livestock grazing, recreation (hiking/fishing), and agricultural crop production (primarily alfalfa). Recreational activities involving elk within the Unit include hunting, photography, viewing/nature study, and shed collecting. Elk are visible from US Highway 395 and a wildlife viewing point near Tinemaha Reservoir provides viewing opportunities.

Elk Distribution and Abundance

In October of 1933, twenty-six tule elk from Yosemite National Park were placed in an enclosure near Aberdeen, and released several days later. This initial translocation was augmented four months later with 28 elk from Buttonwillow (later designated the Tupman Tule Elk State Reserve).

Some residents supported having tule elk in the Owens Valley (Dow 1934), but conflicts developed over competition with livestock for forage and damage to fences and agricultural fields. As conflicts intensified, the California Department of Fish and Wildlife (Department) completed the first the first aerial elk survey of the Owens Valley in 1943 counting 189 tule elk. The Department recommended regulated hunting to resolve depredation conflicts and manage population numbers. From 1943-1969, the Fish and Game Commission (FGC) approved seven tule elk hunts. Advocates of tule elk opposed these hunts, as did farmers and ranchers in the Owens Valley who wanted all the elk removed.

In 1971, State legislation halted tule elk hunting until numbers reached 2000 animals statewide, and established a maximum level of 490 elk for the Owens Valley. A 1976 federal law concurred with the state legislation. From 1971-1988, the Department moved the tule elk from the Owens Valley to keep the population below 490 animals, and to reestablish herds in other locations statewide. Regulated hunting resumed when the statewide population exceeded 2,000 animals, and has occurred annually in the Owens Valley since 1989.

Tule elk have dispersed throughout much of Owens Valley, and are found from Bishop south to Owens Lake. Six Owens Valley subherds (Bishop, Tinemaha, Goodale, Independence, Lone Pine, and Whitney) exist, most established by natural dispersal. The Department moved two cow elk from Goodale into the Whitney subherd area in 1971, but both soon returned to Goodale. In 1972, the Department moved two cows, a yearling cow, and two bulls from Tupman Tule Elk State Reserve to an enclosure near Independence. The yearling cow died several months later and one cow stayed within the Whitney subherd area at least until March 1973, when its radio collar stopped functioning. Some of these elk may have joined the Goodale subherd, but the fate of others is unknown. Elk have moved from Goodale to the Whitney area in the past (Bureau of Land Management et al. 1977), but it is unclear whether the Whitney subherd was established by translocation or dispersal.

The Department has conducted numerous surveys to estimate minimum population numbers, recruitment rates, and sex ratios (Table 1). Most of the information in Table 1 came from fixed-wing aerial surveys (McCullough 1969, Bleich et al. 2001). Department staff conducted helicopter surveys from 1986-1988, and fixed-wing and ground surveys from 2009-2016. Herd size has fluctuated over time and temporarily exceeded the legislated threshold (Tables 2-7). While mortalities from disease, predation, poaching, and roadways have occurred, these factors have not prohibited population growth (Tables 1-7). The current population estimate for the Unit is 280 animals

The 1988 Owens Valley Tule Elk Management Unit Management Plan (California Department of Fish and Game 1988) listed populaton objectives for each subherd as follows:

- Bishop: 80-100 elk;
- Tinemaha: 80-100 elk;
- Goodale: 50-70 elk;
- Independence: 60-80 elk;
- Lone Pine: 60-80 elk;
- Whitney: 40-60 elk.

Between 2011 and 2016 the Department placed 51 GPS radio telemetry collars on elk within the Owens Valley in an effort to better estimate distribution, home ranges, and assist with aerial surveys.

Management Goals, Objectives, and Actions

The management goals for this Unit are to: 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate the take of elk as they move across the landscape; 3) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 4) alleviate human-elk conflicts. Specific objectives and actions recommended to achieve each goal are listed below. Department regional and headquarters staff will perform the identified actions and work with Tribes in co-management efforts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is stable and below the population objective identified in Objective 1.6. The Owens Valley herd is unique in that the maximum population level is set in Section 3951 of the California Fish and Game Code (FGC § 3951) at 490 animals. Through regulated harvest, the Department maintains the elk population below this level. Population management for this Unit involves efforts to increase elk numbers where suitable, while working to reduce or stabilize elk numbers in conflict areas. This will involve a conservative level of regulated elk hunting that promotes natural range expansion and population in areas without conflict, and focused elk hunting and depredation relief in areas where reoccurring conflict with agriculture and humans exists.

The overall habitat management objective is to maintain or improve elk habitat within the Unit. The Department has worked with BLM and DWP to improve habitat conditions within the Owens Valley. Specific recommendations in the 1988 management plan included developing or improving the condition of water sources, especially those that might be marginal for elk, and maintaining or improving the condition of forage in irrigated pastures and wet meadows.

Specific activities to achieve population and habitat objectives for the Unit include the following:

Objective 1.1. Continue and complete projects to estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Continue annual aerial surveys (augmented as necessary with ground surveys). Ongoing.

Action 1.1.2
Continue radio telemetry (GPS/VHF) collar monitoring to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2022.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2023.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects to benefit elk. Ongoing.

Action 1.2.3
Evaluate and/or adjust subherd population objectives based on GPS collar and survey data. Expected completion: 2022.

Action 1.2.4
Coordinate with public land agencies, Tribes, and NGOs and establish a timeline to evaluate the potential for elk translocations within the Owens Valley to enhance genetic diversity. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitats by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with BLM, USFS, California Department of Forestry and Fire Protection, DWP, NGOs, Tribes, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, Tribes, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Work with BLM and DWP to evaluate the condition of water sources and prioritize those that should be developed/improved. Expected completion: 2021.

Action 1.3.5
Work with BLM and DWP to evaluate, maintain, and/or improve irrigated pastures and wet meadows. Expected completion: 2021.

Action 1.3.6
Review the status of livestock grazing allotments and leases administered by BLM and DWP. Expected completion: 2021.

Action 1.3.7
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2025.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2023.

Objective 1.5. Determine genetic diversity of the population by 2023.

Action 1.5.1
Distribute DNA collection kits to elk hunters for submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.2
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects within the Owens Valley. Expected completion: 2023.

Objective 1.6. Maintain a population of 350-450 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population (within required objectives) and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Establish a positive, cooperative relationship with Tribes regarding elk management in recognition that the Department and Tribes share authority to regulate take as elk move across the landscape.

The Department recognizes in its Tribal Communication and Consultation Policy that Tribes are unique and separate governments with inherent tribal sovereignty and is committed to communicating and consulting on a government-to-government basis with Tribes about elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictions and landscapes and to prioritize restoration. However, there is a need to develop greater clarity on the specific processes for management of elk with individual Tribes.

Objective 2.1. Develop co-management agreements, memoranda of agreement, or similar mechanisms for the management of elk in cooperation with Tribes traditionally and culturally affiliated with the Unit by 2021.

Action 2.1.1
Establish a timeline with interested Tribes to develop co-management agreements, memoranda of agreement, or similar mechanisms. Expected completion: 2019.

Action 2.1.2
Contact Tribes and establish a timeline to provide additional input and address other management concerns. Expected completion: 2019.

Objective 2.2. Work with Tribes to complete monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat by 2023.

Action 2.2.1
Collaborate with interested Tribes to identify monitoring and habitat projects and establish a timeline for implementation. Expected completion: 2020.

Action 2.2.2
Coordinate with interested Tribes to identify Department approved research projects utilizing GPS collars. Expected completion: 2023.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program,

participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 3.1. Maintain elk hunting opportunities compatible with population objectives.

Action 3.1.1
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 3.1.2
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Ongoing.

Objective 3.2. Work with other agencies and NGOs to install two additional elk interpretive signs by 2023.

Action 3.2.1
Meet with land agencies to evaluate the possibility of adding and/or updating elk interpretive signs. Expected completion: 2020.

Objective 3.3. Conduct an elk workshop to inform the public about elk and elk viewing opportunities by 2023.

Action 3.3.1
Work with agencies, academia, and NGOs to provide information on elk and elk viewing at the workshop. Expected completion: 2022.

Objective 3.4. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.4.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 4. Alleviate human-elk conflicts and elk depredation complaints.

As the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts.

Historical conflicts in this Unit involved competition with livestock for forage and agricultural damage. Conflicts have subsided, but still occur periodically with some subherds. Identifying an upper limit threshold for the Unit through legislation provided a benchmark for developing harvest strategies and determining Department responses to agricultural damage and land use conflicts. Regulated hunting has maintained

population numbers below the legislated threshold of 490 elk, and alleviated some land use conflicts. Re-evaluating and/or revising population objectives and annual harvests for each subherd may help to reduce conflicts. In addition, the investigation of water developments and other habitat improvement projects away from agricultural fields and pastures as a method of reducing future conflicts should occur.

Providing and improving opportunities for landowners to benefit from having elk on their property may improve tolerance of elk on their properties. Through Cooperative Elk Hunting, Private Land Management, and the SHARE program, landowners with human-elk conflicts can partially offset losses through access fees for hunting and other recreational activities.

The Department will emphasize the use of regulated hunting and co-management with Tribes to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful. The Department may issue depredation permits when readily identifiable animals cause property damage.

Objective 4.1. Reduce reports of human-elk conflicts on private property by at least 25% by 2023.

Action 4.1.1
Map areas of high human-elk conflict and assess potential for alleviating damage by reducing or stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 4.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 4.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 4.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 4.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation.
Ongoing.

Herd Viability

The Owens Valley herd has existed since 1933. Natural dispersal potentially provides for interchange of individuals between subherds. Annual public elk hunting has occurred for over 25 years and has maintained population numbers below the limit of 490 elk specified by legislation, while suppressing numbers in subherds that caused agricultural conflicts. The Owens Valley herd demonstrates a compensatory reproductive response (higher number or survival of young) to periodic reductions caused by hunting and capture/translocation (Table 1); its persistence for over 80 years attests to its viability.

However, it is noteworthy that the Sierra Nevada Mountains prevent natural dispersal of tule elk into or out of the Owens Valley. Translocation of tule elk into the Unit has not occurred since 1972. Periodic translocation of disease-free tule elk into the Unit may promote genetic diversity and contribute to herd viability.

Summary of Annual Harvests

The current harvest strategy maintains the Owens Valley tule elk population to below the legislated threshold, and manage agricultural conflicts by reducing or controlling the size of subherds. This strategy provides hunting opportunities for the general public as well as apprentice hunters, archers and muzzleloader hunters. Harvest strategies since 1989 are summarized below.

- In 1989, the FGC authorized public elk hunting for the Bishop and Lone Pine zones (Tables 8 and 9). However, the 1989 harvest overwhelmingly consisted of bulls; a prolonged bull harvest would have sharply reduced bull to cow ratios and been sub-optimal in controlling population numbers. To better manage sex ratios and subherd population levels, the FGC designated antlerless and bull tags for the Bishop and Lone Pine zones since 1990. The Bishop boundary remains unaltered, whereas the Department has split the Independence, Lone Pine, and West Tinemaha boundaries to create new zones (Goodale, Tinemaha Mountain, and Whitney). Annual hunter success for the Bishop and Lone Pine zones has been high (Tables 8 and 9).

- In 1994, the FGC authorized annual hunting within the Independence Zone (Table 10) and issued antlerless and bull tags to partition the harvest by sex. In 2007, the Department expanded the Independence zone to include the west side of US Highway 395; annual hunter success has been moderate to high.

- In 1998, the FGC authorized annual hunting within the Tinemaha Zone (Table 11). Initially, tagholders could not hunt west of Highway 395. However, in 2004, the Department established the West Tinemaha zone west of Highway 395. This significantly expanded the hunt zone and helped resolve complaints regarding fence and crop damage west of Highway 395. In 2007, the Department expanded the West Tinemaha zone further westward. Table 11 lists tag allocation and harvest for the Tinemaha and West Tinemaha zones from 1998-2016.

- In 2010, The FGC authorized two additional tule elk zones within the Owens Valley: Tinemaha Mountain and Whitney (Tables 12 and 13) by subdividing the West Tinemaha and Lone Pine zones. The Tinemaha Mountain zone was established after CDFW confirmed the presence of a group of bulls west of the Owens Valley and north of Tinemaha Creek, utilizing higher elevations at the Tinemaha subherd's western boundary, extending into the Inyo National Forest. The Tinemaha Mountain zone is not used extensively by tule elk, especially the larger cow-calf groups. Quotas and harvests for these hunts are conservative compared to other Owens Valley zones. Hunter success has been moderate to high.

- In 2002, the FGC authorized Owens Valley archery-only tags. Prior to 2002, elk could be taken with archery gear but no tags or hunt periods existed solely for archers. Table 14 lists archery-only quotas and harvests for the Owens Valley from 2002-2015. Tags in Table 14 were valid for multiple zones (for example, archery-only tags in 2015 were valid for the Bishop, Independence, Lone Pine, Tinemaha Mountain and Whitney zones). Besides those listed in Table 14, additional archery-only tags are designated for Lone Pine (Table 9), Independence (Table 10), and Tinemaha/West Tinemaha (Table 11).

- Starting in 2007, the FGC approved muzzleloader and apprentice hunts for the Unit. Muzzleloader tags were issued for the Bishop (Table 8), Lone Pine (Table 9), and Independence (Table 10) zones; apprentice tags were issued for the Bishop Zone (Table 8).

Careful hunt monitoring is necessary at liberal harvest levels to ensure that no adverse impacts to the population occur. The Department reduced the total Owens Valley tag quota for 2015 based on population survey results (Table 1).

Figures 1-6 depict the mean age of antlered (bulls) and antlerless elk taken within the Owens Valley by hunters. Sample sizes are relatively small for some years and/or zones, and age structure trends (increasing or decreasing) are not immediately apparent. However, these figures indicate that most elk taken by hunters had survived past the age of first reproduction. Bull to cow ratios from surveys since 1996 were generally well above the desired minimum of 25 bulls per 100 cows, especially since 2007 (Table 1). Thus, while prolonged harvests at liberal levels warrant close monitoring, past results for this Unit demonstrate that public elk hunting could be

sustained indefinitely in the Owens Valley given a harvest strategy that periodically adjusts tag quotas based on monitoring results.

Unit Highlights

The Owens Valley herd is second only to Cache Creek in longevity as a free-ranging tule elk herd. Prior to 1989, the Department used periodic public hunts to manage population levels and reduce or control the size of individual subherds. During the period that hunting was prohibited (1971-1988), Department staff captured and relocated 434 elk from the Owens Valley, to reestablish herds elsewhere and reduce or maintain numbers below the legislated threshold for the Owens Valley. Regulated annual harvests resumed in 1989 as the need for surplus animals for reintroduction began to decline. Regulated tule elk hunting in the Owens Valley now serves three purposes: to control elk population numbers below the legislated threshold; to alleviate agricultural and/or private property conflicts; and to provide public recreational opportunities.

- From 2004-2007, the Department initiated a study to determine mineral deficiencies and causes and effects of antler breakage on tule elk within the Owens Valley.

- From 2011-2016, the Department placed 51 GPS collars on elk to estimate distribution, home range, and movement patterns.

Some management actions in the Owens Valley were controversial, particularly the periodic hunts that occurred prior to 1969. However, after extensive research, monitoring, and management activities the level of controversy has subsided. The Department has collaborated with DWP, BLM, USFS, the academic community, NGOs, and private landowners to implement/accomplish numerous elk research and management activities within the Unit. A partial listing of products from these efforts includes the following:

Unit Specific Research

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Data Tables/Figures

Table 1. Owens Valley Tule Elk Management Unit, Population Survey Results and Herd History. Surveys did not occur or results were unavailable for years not listed. (Source: CDFW files; H denotes helicopter survey).

	Number of Elk Counted					Removed	
Year	**Bulls**	**Cows**	**Calves**	**Unknown**	**Total**	**Hunting**	**Relocated**
1933	7	11	6	3	**27**		
1934	10	30	12	3	**55**		
1943	60	97	32		**189**	43	
1944	9	94	26		**129**		
1945	34	202	32		**268**		
1946	37	221	47		**305**		
1947	38	174	53		**265**		
1948	68	191	61		**320**		
1949	73	350	72		**495**	107	
1950	?	?	?		**153**		
1951	?	?	?		**199**		
1952	40	92	28	62	**222**		
1953	60	156	40		**256**		
1954	33	117	42		**192**		
1955	36	224	43		**303**	144	
1956	46	108			**154**		
1957	33	141			**174**		
1958	63	162			**225**		
1958	59	109		84	**252**		
1960	59	222		4	**282**		
1960	35	166	42		**243**		
1960	82	245			**327**		
1961	94	156	45	1	**296**	40	
1961	89	224			**313**		
1962	91		11		**102**	59	
1962	90	154			**244**		
1963	45	102	30		**177**		
1963	89	219			**308**		
1964	88	157	37		**282**		
1964	85	194			**279**	50	
1965	59	90	31		**180**		
1966	68	172	47	3	**290**		
1967	64	128	54	0	**246**		
1968	93	181	61	0	**335**		
1969	68	209	51	2	**330**	78	
1970	37	150	41	0	**228**		
1970	59	175	58	0	**292**		
1971	65	161	65	0	**291**		
1972	52	194	34	0	**280**		
1973	79	195	66	0	**340**		
1974	65	245	65	0	**375**		
1975	98	245	59	0	**400**		
1976	101	300	77	0	**478**		
1977	143	354	85	0	**582**		79
1978	124	301	89	0	**514**		51
1978	138	285	90	0	**514**		
1979	143	262	82	0	**487**		
1980	132	302	99	0	**533**		101
1981	121	263	92	0	**476**		33
1982	117	247	82	0	**446**		

Table 1. Owens Valley Tule Elk Management Unit, Population Survey Results and Herd History (Continued).

Year	Number of Elk Counted					Removed	
	Bulls	Cows	Calves	Unknown	Total	Hunting	Relocated
1983	111	269	115	0	**495**		
1984	151	328	130	0	**609**		
1985	158	365	77	0	**600**		170
1986	105	242	82	0	**429**		
1986H	155	264	100	0	**519**		
1987	129	268	68	0	**465**		
1987H	151	302	71	0	**524**		
1988	123	235	67	0	**425**		
1988H	194	297	72		**563**		
1989	104	241	54		**399**	77	
1990	81	237	40		**358**	36	
1991	69	227	45		**341**	44	
1992				2	**600**	37	
1993				3	**429**	22	
1994					**218**	29	
1995					**251**	24	
1996	95	176	65		**336**	21	
1997	68	149	51		**268**	19	
1998	83	169	46		**298**	29	
1999	65	127	35	70	**297**	26	
2000	86	208	48		**342**	43	
2001	63	181	55		**299**	26	
2002	70	208	30	0	**308**	22	
2003	58	238	56	0	**352**	19	
2004	81	192	57		**330**	27	
2005	52	238	58		**348**	19	
2006	49	362	42		**453**	19	
2007	81	291	33		**405**	75	
2008	58	165	57		**280**	69	
2009	134	188	71		**393**	55	
2010	87	178	48		**313**	66	
2011	136	176	57		**369**	64	
2012	129	109	50		**288**	64	
2013	92	79	14		**185**	49	
2014	90	73	26		**189**	35	
2015	74	96	38		**208**	26	
2016	77	121	55		**253**	11	
2017	60	131	52		**243**		

Table 2. Bishop Subherd, Survey Results and Subherd History.

Surveys did not occur or results were unavailable for years not listed. (Source: CDFW files; H denotes helicopter survey).

Year	Number of Elk Counted					Number Relocated
	Bulls	Cows	Calves	Unknown	Total	
1964					**51**	
1966	13	28	8		**49**	
1967	11	37	16		**64**	
1968	23	31	12		**66**	
1969	15	43	9		**67**	
1970	12	37	11		**60**	
1970	10	43	15		**68**	
1971	18	48	14		**80**	
1972	16	67	6		**89**	
1973	20	56	14		**90**	
1974	24	53	16		**93**	
1975	32	55	8		**95**	
1976	21	54	14		**89**	
1977	26	90	17		**133**	25
1978	29	65	11		**105**	14
1978	34	67	20		**121**	
1979	37	51	18		**106**	
1980	43	79	16		**138**	75
1981	30	30	13		**73**	
1982	26	37	12		**75**	
1983	27	48	15		**90**	
1984	33	54	15		**102**	
1985	32	64	13		**109**	
1986	34	64	21		**119**	
1986H	36	69	24		**129**	
1987	44	74	18		**136**	
1988	31	86	19		**136**	
1988H	62	85	22		**169**	
1989	30	75	14		**119**	
1990	11	63	12		**86**	
1991	21	61	6		**88**	
1992	18	41	3		**62**	
1993	16	16	5		**37**	
1994						
1995						
1996	16	33	6		**55**	
1997	12	27	8		**47**	
1998	10	36	5		**51**	
1999	1	21	5		**27**	
2000	9	32	6		**47**	
2001	7	45	12		**64**	
2002	16	42	7		**65**	
2003	13	62	13		**88**	
2004	12	51	13		**76**	
2005	11	63	16		**90**	
2006	3	104	8		**115**	
2007	11	81	6		**98**	
2008	13	51	16		**80**	
2009	17	44	12		**73**	
2010	30	38	5		**73**	
2011	13	28	9		**50**	
2012	26	10	6		**42**	
2013	11	11	4		**26**	
2014	9	6	0		**15**	
2015	7	9	2		**18**	
2016	5	10	4		**19**	
2017	4	10	5		**19**	

Table 3. Lone Pine Subherd Survey Results and Subherd History.

Surveys did not occur or results were unavailable for years not listed. (Source: CDFW files; H denotes helicopter survey).

Year	Number of Elk Counted					Number Relocated
	Bulls	Cows	Calves	Unknown	Total	
1964					**61**	
1966	8	12	7	1	**28**	
1967	16	23	9		**48**	
1968	14	24	12		**50**	
1969	20	33	6		**59**	
1970	18	34	10		**62**	
1971	17	21	14		**52**	
1972	10	33	7		**50**	
1973	16	32	14		**62**	
1974	15	56	9		**80**	
1975	21	34	12		**67**	
1976	21	55	15		**91**	
1977	19	56	14		**89**	
1978	20	52	22		**94**	
1978	25	62	19		**96**	
1979	17	64	20		**101**	
1980	39	69	24		**132**	
1981	43	71	22		**136**	
1982	27	53	17		**97**	
1983	27	65	32		**124**	
1984	23	68	22		**113**	
1985	33	67	13		**113**	63
1986	9	51	17		**77**	
1986H	30	57	20		**107**	
1987	14	80	26		**120**	
1987H	32	99	32		**163**	
1988	40	55	20		**115**	
1988H	55	100	30		**185**	
1989	28	87	21		**136**	
1990	24	91	12		**127**	
1991	22	73	13		**108**	
1992	29	79	7		**115**	
1993	21	60	24		**105**	
1994					**90**	
1995						
1996	24	44	9		**77**	
1997	23	36	20		**79**	
1998	35	19	7		**61**	
1999	22	35	11		**68**	
2000	21	31	10		**62**	
2001	15	20	9		**44**	
2002	21	38	7		**66**	
2003	15	25	9		**49**	
2004	7	7	3		**17**	
2005	4	20	5		**29**	
2006	15	26	8		**49**	
2007	11	14	7		**32**	
2008	4	8	2		**14**	
2009	19	16	5		**40**	
2010	20	36	15		**71**	
2011	20	25	8		**53**	
2012	15	20	9		**44**	
2013	33	42	9		**84**	
2014	25	24	5		**54**	
2015	27	29	12		**68**	
2016	29	35	16		**80**	
2017	25	28	11		**64**	

Table 4. Independence Subherd Survey Results and Subherd History. Surveys did not occur or results were unavailable for years not listed. (Source: CDFW files; H denotes helicopter survey).

Year	Number of Elk Counted					Number Relocated
	Bulls	Cows	Calves	Unknown	Total	
1964					**67**	
1966	23	58	17		**98**	
1967	7	14	7		**28**	
1968	16	34	12		**62**	
1969	6	24	5		**35**	
1970	2	8	4		**14**	
1970	9	22	11		**42**	
1971	11	20	9		**40**	
1972	11	30	9		**50**	
1973	18	30	10		**58**	
1974	9	43	9		**61**	
1975	15	60	11		**86**	
1976	27	74	12		**113**	
1977	33	62	16		**111**	20
1978	37	54	22		**113**	16
1978	35	52	21		**108**	
1979	42	53	12		**107**	
1980	21	58	18		**97**	
1981	22	52	17		**91**	
1982	33	64	24		**121**	
1983	12	43	17		**72**	
1984	36	90	43		**169**	
1985	40	84	24		**148**	44
1986	11	41	14		**66**	
1986H	38	40	15		**93**	
1987	34	25	9		**68**	
1987H	32	38	6		**76**	
1988	25	19	5		**49**	
1988H	30	30	6		**66**	
1989	22	20	7		**49**	
1990	20	19	2		**41**	
1991	7	19	7		**33**	
1992						
1993					**55**	
1994	17	25	6		**48**	
1995						
1996	5	12	6		**23**	
1997	3	11	1		**15**	
1998	8	10	4	2	**24**	
1999	13	14	7		**34**	
2000	23	47	12		**82**	
2001	5	13	4		**22**	
2002	5	12	4		**21**	
2003	1	13	3		**17**	
2004	0	0	0		**0**	
2005	4	31	2		**37**	
2006	7	39	3		**49**	
2007	9	34	3		**46**	
2008	1	6	1		**8**	
2009	13	32	10		**55**	
2010	12	40	11		**63**	
2011	25	43	10		**78**	
2012	12	25	10		**47**	
2013	8	0	0		**8**	
2014	24	34	15		**73**	
2015	12	21	10		**43**	
2016	17	26	10		**53**	
2017	12	40	10		**62**	

Table 5. Tinemaha Subherd Survey Results and Subherd History. Surveys did not occur or results were unavailable for years not listed. (Source: CDFW files; H denotes helicopter survey).

Year	Number of Elk Counted					Number Relocated
	Bulls	Cows	Calves	Unknown	Total	
1964					**39**	
1966	16	34	9		**59**	
1967	27	45	18		**90**	
1968	28	46	11		**85**	
1969	17	42	16		**75**	
1970	2	31	6		**39**	
1970	4	29	6		**39**	
1971	2	30	11		**43**	
1972	5	39	6		**50**	
1973	11	53	20		**84**	
1974	11	59	15		**85**	
1975	19	53	12		**84**	
1976	12	65	19		**96**	
1977	33	70	11		**114**	25
1978	25	67	15		**107**	11
1978	21	56	20		**97**	
1979	33	55	7		**95**	
1980	15	49	21		**85**	26
1981	13	80	25		**118**	33
1982	23	51	21		**95**	
1983	22	59	25		**106**	
1984	37	46	27		**110**	
1985	25	75	12		**112**	63
1986	24	37	14		**75**	
1986H	22	37	18		**77**	
1987	19	43	9		**71**	
1988	15	40	10		**65**	
1988H	33	47	11		**91**	
1989	16	39	10		**65**	
1990	19	37	10		**66**	
1991	11	46	13		**70**	
1992						
1993						
1994						
1996	50	87	44		**181**	
1997	33	86	23		**142**	
1998	30	104	30		**164**	
1999	29	57	12	70	**168**	
2000	12	48	11		**71**	
2001	10	23	4		**37**	
2002	7	17	2		**26**	
2003	25	129	27		**181**	
2004	5	125	18		**148**	
2005	33	124	35		**192**	
2006	22	159	17		**198**	
2007	49	162	17		**228**	
2008	37	96	38		**171**	
2009	68	73	34		**175**	
2010	20	44	12		**76**	
2011	52	30	12		**94**	
2012	49	15	10		**74**	
2013	25	11			**36**	
2014	30	10	8		**48**	
2015	18	10	5		**33**	
2016	15	16	7		**38**	
2017	9	15	11		**35**	

Table 6. Whitney Subherd Survey Results and Subherd History. Surveys did not occur or results were unavailable for years not listed. (Source: CDFWfiles; H denotes helicopter survey).

Year	Number of Elk Counted				Total
	Bulls	Cows	Calves	Unknown	
1972	0	3	2		**5**
1973	0	0	0		**0**
1974	0	0	0		**0**
1975	0	0	0		**0**
1976	0	0	0		**0**
1977	10	5	4		**19**
1978	4	0	0	1	**5**
1979	6	20	13		**39**
1980	4	22	11		**37**
1981	12	24	15		**51**
1982	6	23	6		**35**
1983	17	32	15		**64**
1984	11	40	13		**64**
1985	18	42	9		**69**
1986	20	30	10		**60**
1986H	15	32	8		**55**
1987	16	28	4		**48**
1988	7	27	9		**43**
1988H	12	35	3		**50**
1989	8	20	2		**30**
1990	7	27	4		**38**
1991	8	28	6		**42**
1993					
1996	Not Surveyed				
1997	Not Surveyed				
1998	Not Surveyed				
1999	Not Surveyed				
2000	13	34	7		**54**
2001	26	80	26		**132**
2002	8	22	2		**32**
2003	4	9	4		**17**
2004					**0**
2005					**0**
2006	2	34	6		**42**
2007	1	0	0		**1**
2008	3	4			**7**
2009	17	23	10		**50**
2010	5	20	5		**30**
2011	14	40	13		**67**
2012	20	26	8		**54**
2013	15	15	1		**31**
2014	1	0	0		**1**
2015	5	12	1		**18**
2016	5	13	7		**25**
2017	5	15	8		**28**

Table 7. Goodale Subherd Survey Results and Subherd History. Surveys did not occur or results were unavailable for years not listed. (Source: CDFW files; H denotes helicopter survey).

Year	Number of Elk Counted					Number Relocated
	Bulls	Cows	Calves	Unknown	Total	
1964					**61**	
1966	8	40	6	2	**56**	
1967	3	9	4		**16**	
1968	12	46	14		**72**	
1969	10	67	15		**92**	
1970	14	47	13		**74**	
1970	18	47	16		**81**	
1971	17	42	17		**76**	
1972	10	22	4		**36**	
1973	30			33	**63**	
1973	14	24	8		**46**	
1974				83	**83**	
1974	6	34	16		**56**	
1975	15			52	**67**	
1975	9	43	16		**68**	
1976	20	52	17		**89**	
1977	22	71	23		**116**	9
1978	11	54	41		**79**	10
1978	19	58	10		**87**	
1979	8	19	12		**39**	
1980	10	25	9		**44**	
1981	1	6	0		**7**	
1982	2	19	2		**23**	
1983	6	22	22		**39**	
1984	11	30	10		**51**	
1985	10	33	9		**49**	
1986	7	19	6		**32**	
1986H	14	29	15		**58**	
1987	2	18	2		**22**	
1987H	8	20	2		**30**	
1995						
1996	Not surveyed					
1997	Not surveyed					
2000	21	50	9		**80**	
2001						
2002	8	22	2		**32**	
2003	4	9	4		**17**	
2004						
2005						
2006						
2007	1	0	0		**1**	
2008						
2009	17	23	10		**50**	
2010						
2011	12	10	5		**27**	
2012	7	13	7		**27**	
2013	8	0	0		**8**	
2015	5	15	8		**28**	
2016	6	21	11		**38**	
2017	5	23	7		**35**	

Table 8. Bishop Tule Elk Hunt, Tag Quotas, and Harvests, 1989-2016.

Year	General Either-Sex			Bull		Antlerless		Muzzleloader Bull		Muzzleloader Antlerless		Apprentice Antlerless	
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1989	40	35	2										
1990						10	10						
1991						15	15						
1992						15	13						
1993				7	7	2	1						
1994				4	4								
1995				4	4								
1996				5	5								
1997				4	4								
1998				1	1								
1999				1	1								
2000				1	1								
2001				1	1								
2002				1	1								
2003				1	0								
2004				1	1								
2005				1	1								
2006				1	1								
2007				5	4	12	11	1	1	4	4	4	4
2008				1	1	12	11	1	1	4	4	4	4
2009				1	0	12	8	1	0	4	4	4	3
2010				2	2	6	5	1	1	3	2	3	3
2011				3	2	9	7	2	2	3	2	3	3
2012				3	2	9	6	2	2	3	2	3	1
2013				4	4			2	2			2	0
2014				2	2			2	2				
2015				2	2								
2016				0	0								
Totals	**40**	**35**	**2**	**56**	**51**	**102**	**87**	**12**	**11**	**21**	**18**	**23**	**18**
Success Rate	**93%**			**91%**		**85%**		**92%**		**86%**		**78%**	

Table 9. Lone Pine Tule Elk Hunt, Tag Quotas, and Harvests, 1989-2016.

Year	General Either-Sex			Bull		Antlerless		Muzzleloader Bull		Muzzleloader Antlerless		Archery Only Bull		Archery Only Antlerless	
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1989	40	38	2												
1990						30	26								
1991				4	4	25	25								
1992				1	1	25	23								
1993				4	4	12	10								
1994				5	5	12	11								
1995				4	4	12	9								
1996				4	3	12	10								
1997				5	4	12	10								
1998				4	3	8	7								
1999				4	4	8	5								
2000				4	4	8	7								
2001				5	5	8	8								
2002				4	4	8	8								
2003				5	5	8	6								
2004				4	4	8	8								
2005				4	3	8	6								
2006				4	4	8	6								
2007				2	2	8	7	1	1	1	1				
2008				3	3	8	5	1	1	1	1				
2009				3	2	8	7	1	1	1	1				
2010				2	2	6	6					2	1		
2011				2	2	9	5					2	2	3	0
2012				2	2	11	7					2	2	3	1
2013				4	3	9	7					2	1	3	0
2014				6	6										
2015				4	4										
2016				3	3	1	1								
Totals	**40**	**38**	**2**	**96**	**90**	**272**	**230**	**3**	**3**	**3**	**3**	**8**	**6**	**9**	**1**
Success Rate	**100%**			**94%**		**85%**		**100%**		**100%**		**75%**		**11%**	

Table 10. Independence Tule Elk Hunt, Tag Quotas, and Harvests, 1994-2016.

Year	Bull		Antlerless		Archery Only Bull		Muzzleloader Bull		Muzzleloader Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1994	4	4	6	5						
1995	5	5	6	2						
1996	4	3	6	0						
1997	1	1								
1998	1	1								
1999	1	1								
2000	1	1								
2001	1	1								
2002	1	1								
2003	1	1								
2004	1	1								
2005	1	1								
2006	0	0	0	0	0	0				
2007					1	0				
2008					1	0				
2009					1	1				
2010			6	5			1	1	2	1
2011			9	8			2	1	3	2
2012	2	2	12	8			2	2	3	3
2013	4	4	9	9			2	2	3	2
2014	4	4	2	0			2	2		
2015	2	2					1	1		
2016	1	1	2	1			1	1		
Totals	**35**	**34**	**58**	**38**	**3**	**1**	**11**	**10**	**11**	**8**
Success Rate	**97%**		**66%**		**33%**		**91%**		**73%**	

Table 11. Tinemaha Tule Elk Hunt, Tag Quotas, and Harvests, 1998-2016.
Note: Quotas and harvests from 2004-2015 include both the Tinemaha West and Tinemaha Zones.

Year	Bull		Antlerless		Archery Only Bull		Archery Only Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1998	7	7	10	10				
1999	7	6	10	9				
2000	13	13	30	17				
2001	10	9	20	2				
2002	7	5	11	0				
2003	2	2						
2004					6	6	6	2
2005					6	1	6	3
2006					6	3	6	3
2007	4	4	36	27	1	1	6	4
2008	4	3	36	28	1	1	6	2
2009	4	4	36	20	1	1	6	1
2010	4	3	29	21	2	1		
2011	4	4	19	11	2	1		
2012	4	4	11	6	2	0		
2013	6	5			2	0		
2014	4	4			1	0		
2015	3	3			1	0		
2016					1	1		
Totals	**83**	**76**	**248**	**151**	**32**	**16**	**36**	**15**
Success Rate	**92%**		**61%**		**50%**		**42%**	

* Changed from reported harvest of 1 in 2002 DED, to reported harvest of 2 based on hunt database.

Table 12. Tinemaha Mountain Tule Elk Hunt, Tag Quotas, and Harvests, 2010-2016.

Year	Bull		Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest
2010	2	2		
2011	2	1		
2012	2	1		
2013	1	0		
2014	1	0		
2015	2	2		
2016	0	0		
Totals	**10**	**6**	**0**	**0**
Success Rate	**60%**			

Table 13. Whitney Tule Elk Hunt, Tag Quotas, and Harvests, 2010-2016.

Year	Bull		Antlerless		Archery - Bull	
	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
2010	1	1	4	4		
2011	1	1	4	4		
2012	2	2	12	7		
2013	2	2	11	7	2	2
2014	2	2				
2015	2	2				
2016	0	0				
Totals	**10**	**10**	**31**	**22**	**2**	**2**
Success Rate	**100%**		**71%**		**100%**	

Table 14. Owens Valley Archery Only Tule Elk Hunt, Tag Quotas and Harvests, 2002-2016. Note: Quota/Harvest for 2011 includes one tag issued through cooperative elk hunting.

	Either-Sex			Bull	
Year	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest
2002	5	2	1		
2003	7	5			
2004	7	5			
2005	7	4			
2006	5	2			
2007	5	4			
2008	5	4			
2009	5	2			
2010				5	5
2011				6	6
2012				5	4
2013				5	1
2014				5	3
2015				5	5
2016				3	3
Totals	**46**	**28**	**1**	**34**	**27**
Success Rate	**63%**			**93%**	

Figure 1. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Bishop Tule Elk Management Unit, 1989 - 2015. Sample sizes are denoted above bars for each year.

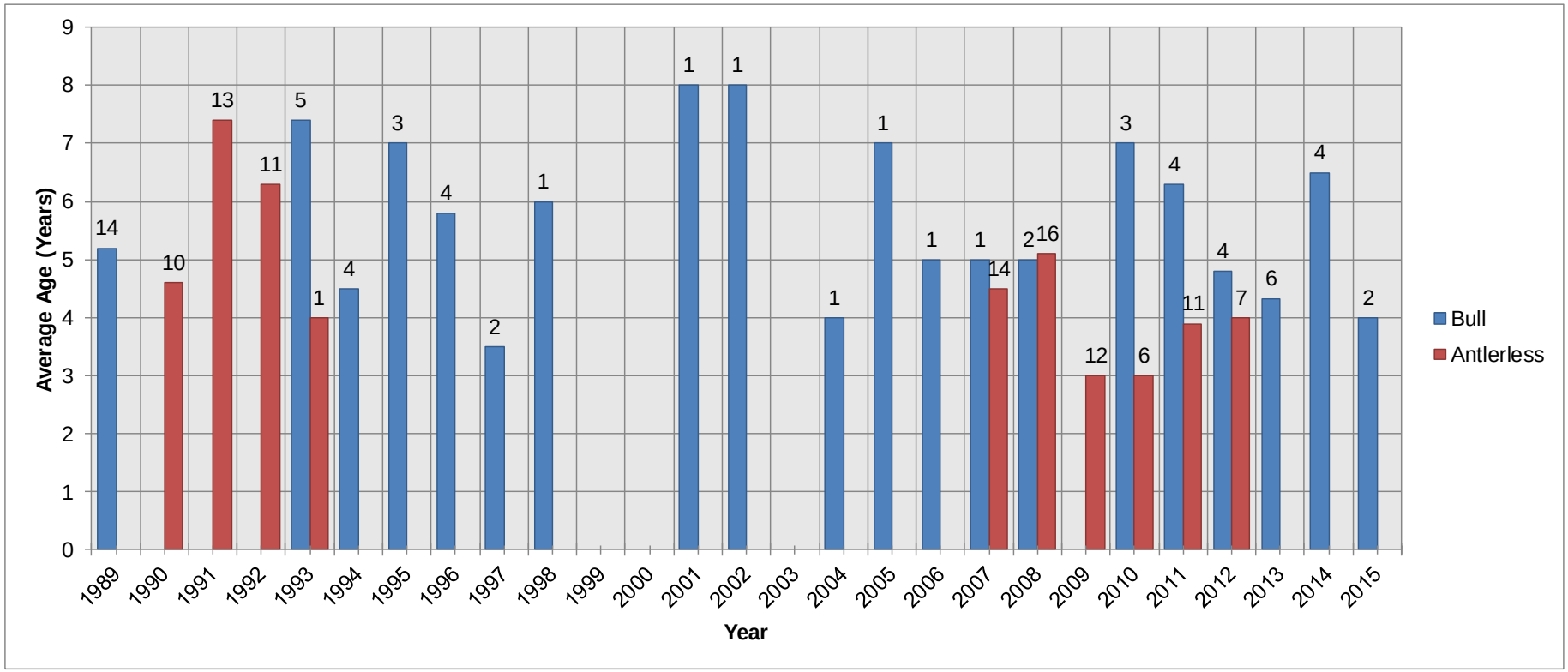


Figure 2. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Lone Pine Tule Elk Management Unit, 1989 - 2015. Sample sizes are denoted above bars for each year.

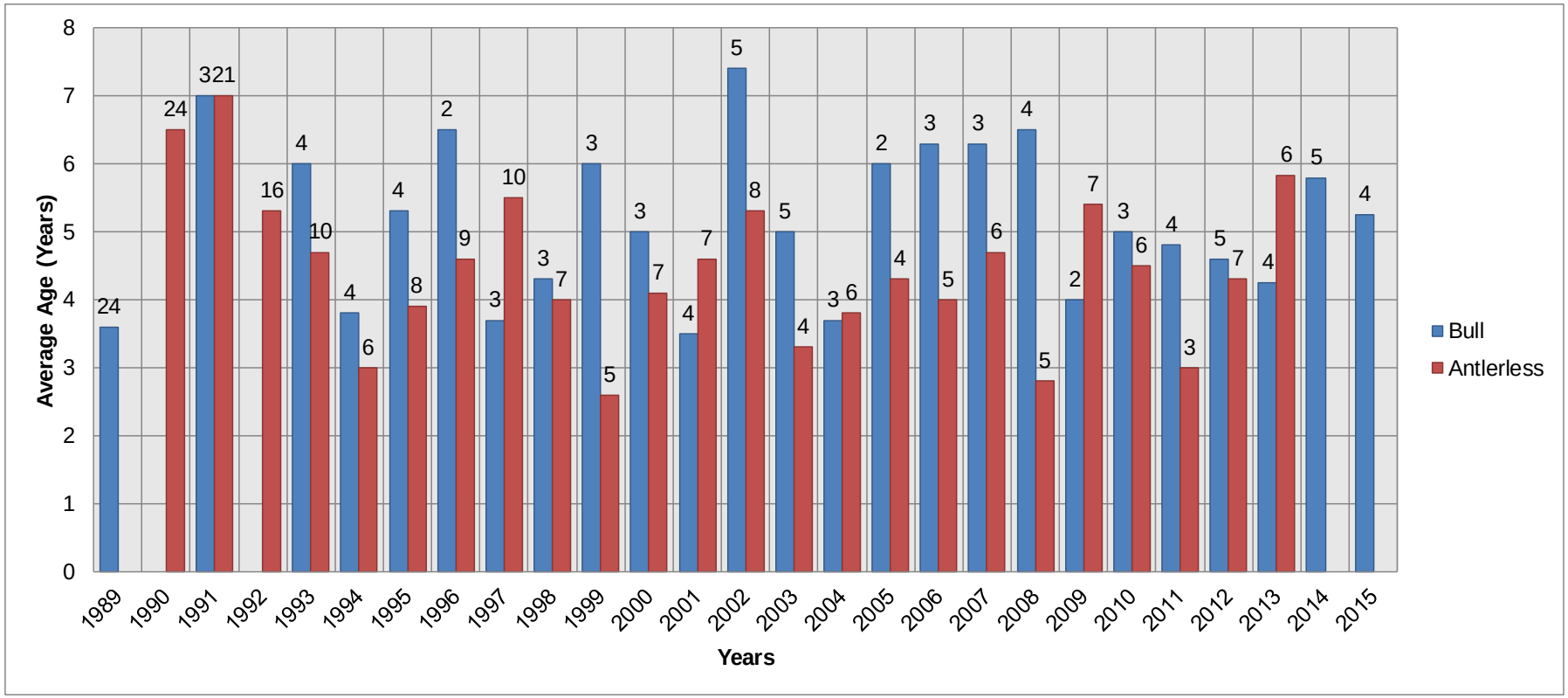


Figure 3. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Independence Tule Elk Management Unit, 1994 - 2015. Sample sizes are denoted above bars for each year.

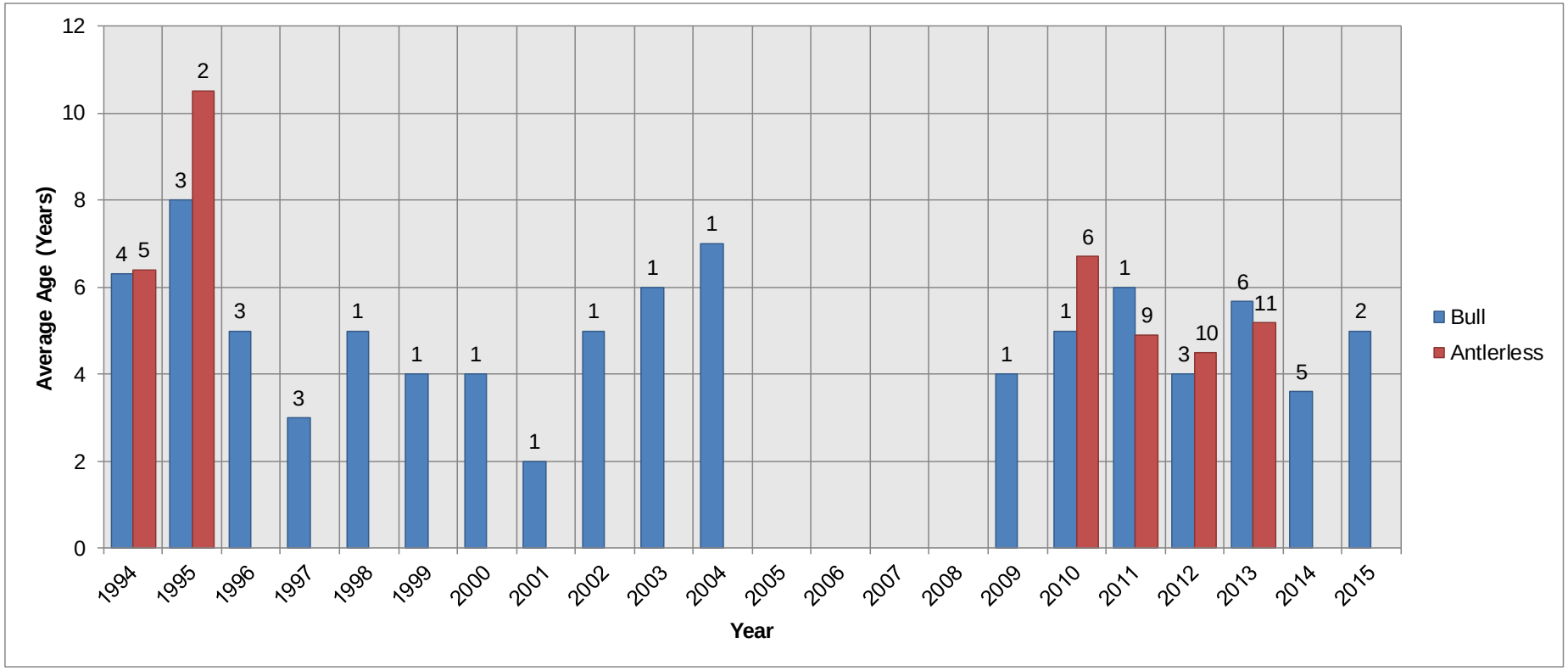


Figure 4. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Tinemaha Tule Elk Management Unit, 1998 - 2015. Note: Age data from 2004-2009 include both the Tinemaha and West Tinemaha zones. Age data from 2010-2015 include Tinemaha, West Tinemaha, and Tinemaha Mountain zones. Sample sizes are denoted above bars for each year.

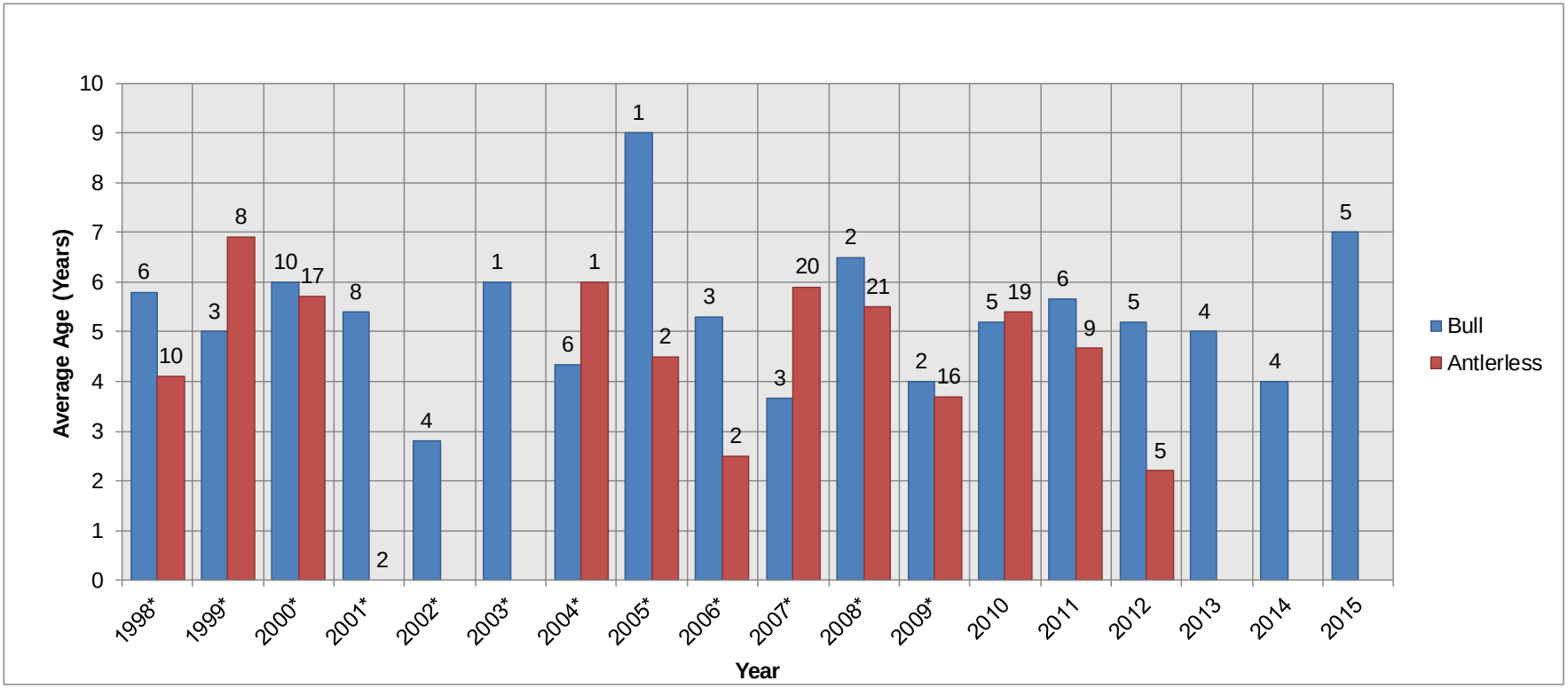


Figure 5. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Whitney Tule Elk Management Unit, 2010 - 2015. Sample sizes are denoted above bars for each year.

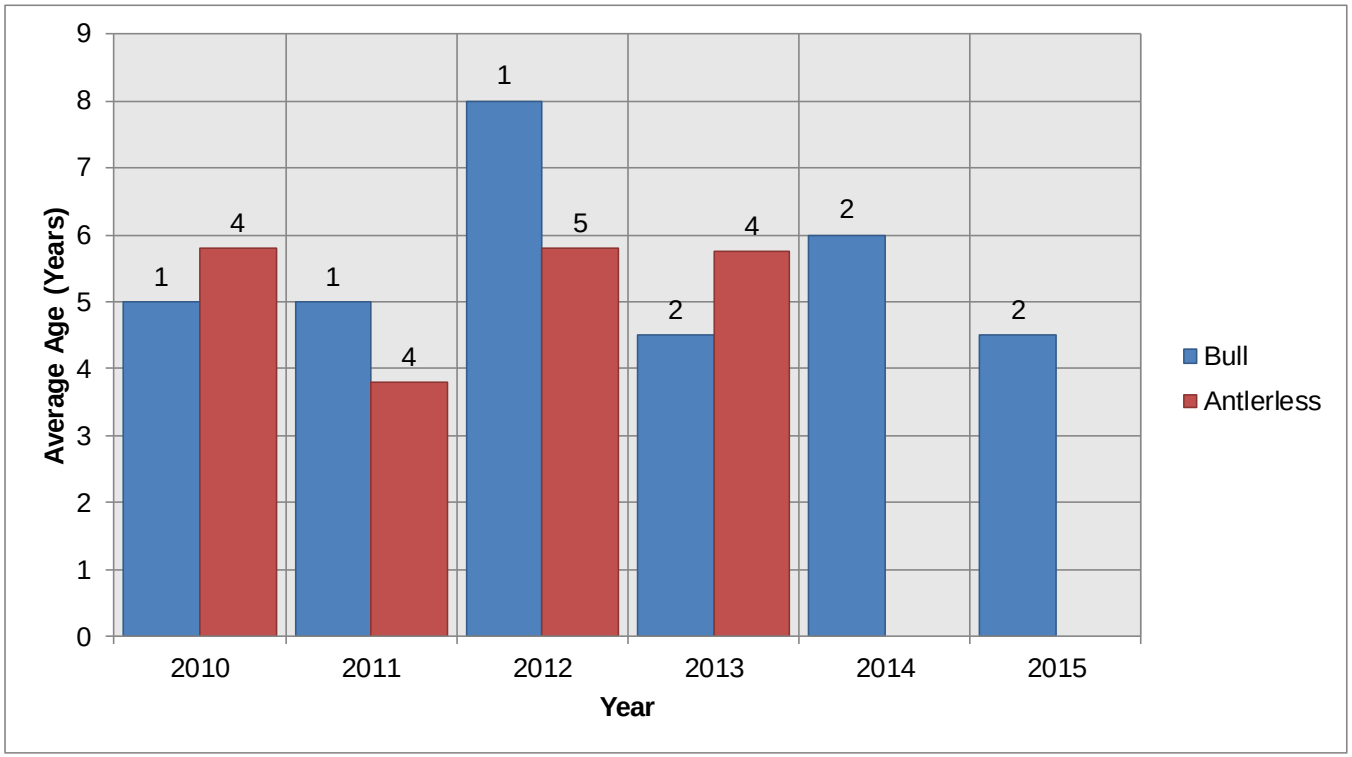
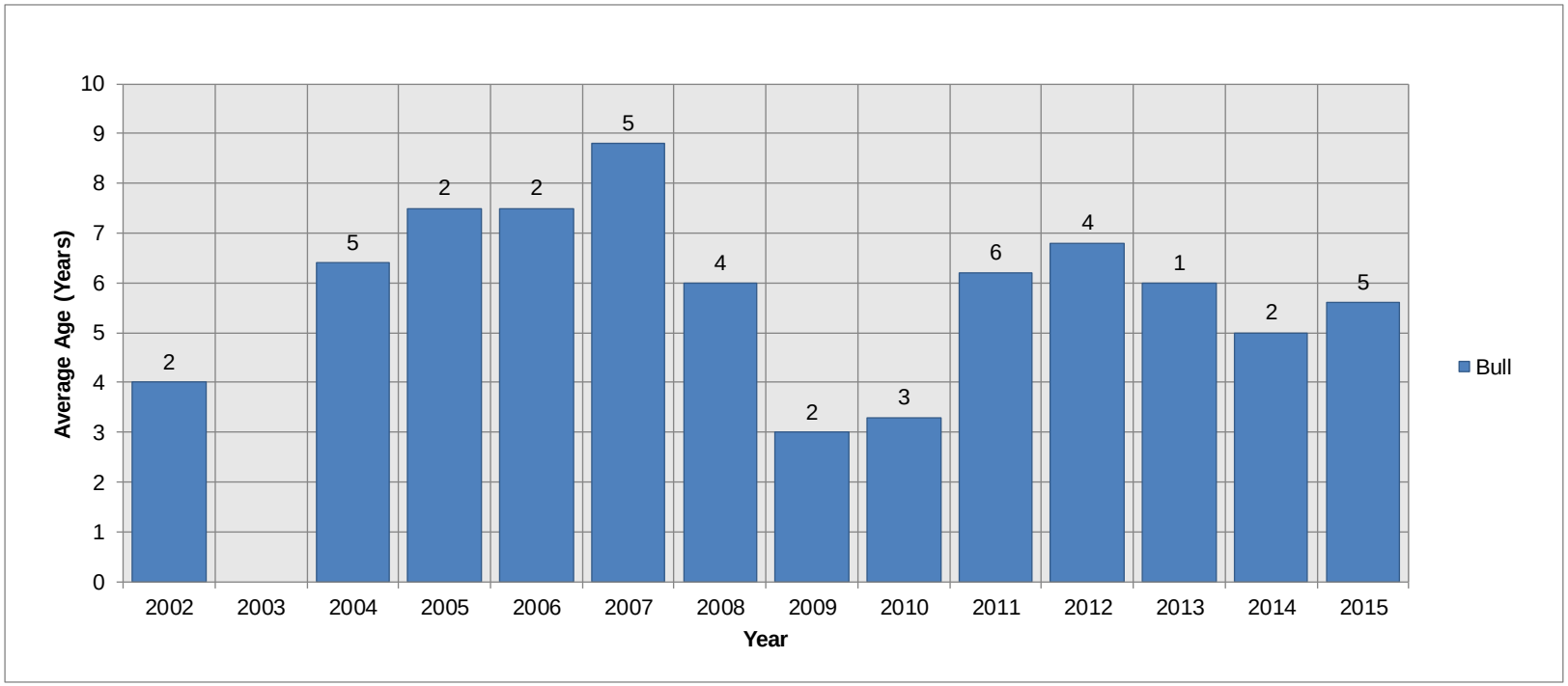
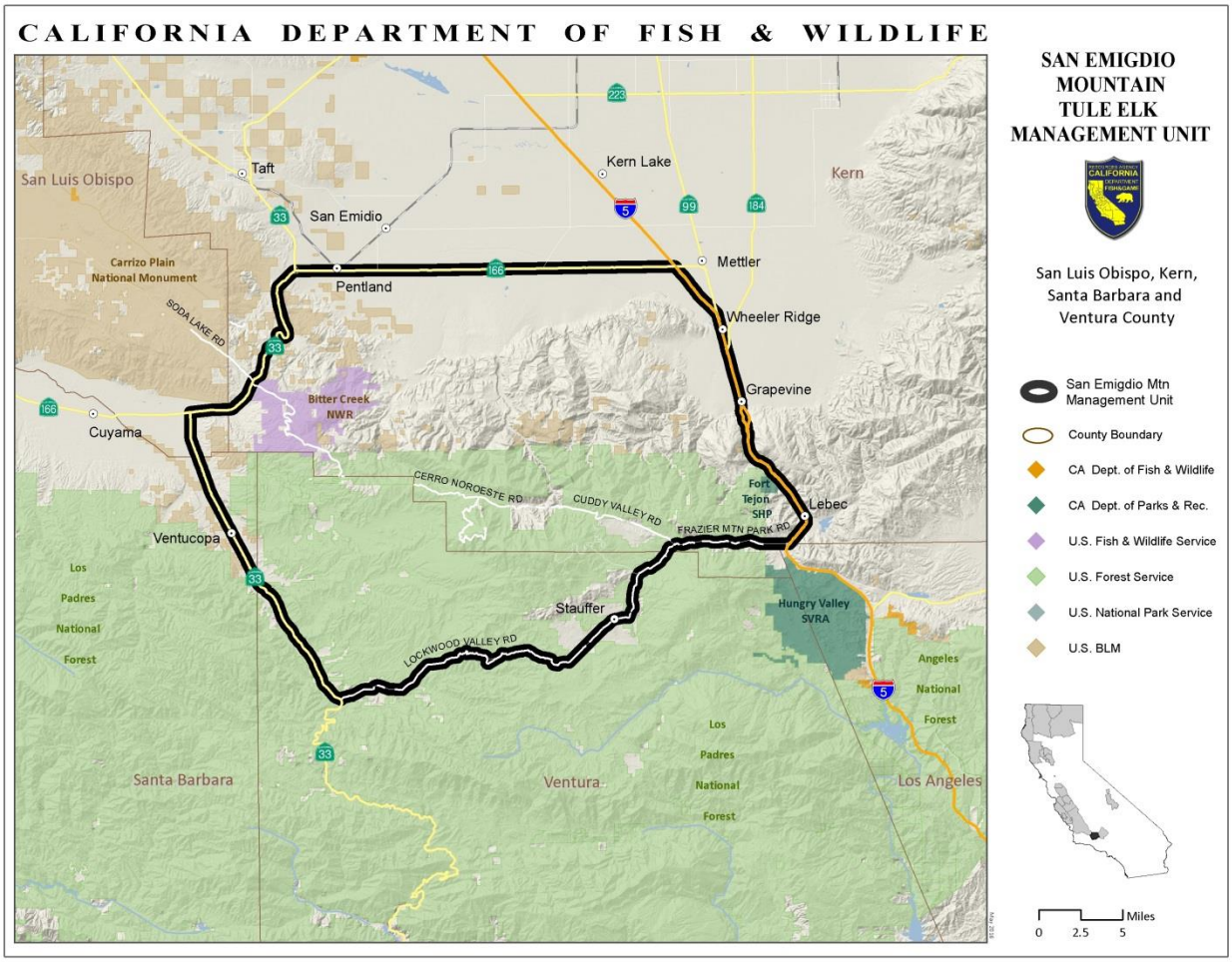


Figure 6. Average Age of Antlered Elk taken by Archery Only Hunting within the Owens Valley Tule Elk Management Unit, 2002 - 2015. Note: Age data for 2011 Includes One Tag Issued through Cooperative Elk Hunting. Sample sizes are denoted above bars for each year.



San Emigdio Mountain Tule Elk Management Unit



San Emigdio Mountains
Tule Elk Management Unit

Description

The San Emigdio Mountains Tule Elk Management Unit (Unit) includes portions of Kern, San Luis Obispo, Santa Barbara and Ventura counties, with boundaries as follows: within a line beginning at the junction of Highway 166 (Maricopa Highway) and Interstate Highway 5 in Kern County; west along Highway 166 to where it joins Highway 33 (West Side Highway) near Maricopa; south and west along highways 166 and 33 to their point of divergence in San Luis Obispo County; south along Highway 33 to Lockwood Valley Road in Ventura County; east and north along Lockwood Valley Road to Lake of the Woods where Lockwood Valley Road becomes Frazier Mountain Park Road; west along Frazier Mountain Park Road to Interstate Highway 5; and north along Interstate Highway 5 to the point of beginning.

The Unit is within the Central Valley and Sierra Nevada, and South Coast Provinces as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). The San Emigdio Mountains are part of the Transverse Ranges and form the southern wall of the San Joaquin Valley linking the Temblor Range to the west with the Tehachapi Mountains to the east. Elevation ranges from approximately 600 feet at the northeastern corner of the Unit to over 8800 feet at Mt. Pinos. Lower elevations contain valley floor and rolling hill grasslands that transition into mixed chaparral habitat at mid-elevations. The chaparral transitions into mixed conifers at the higher elevations, which receive little use by tule elk *(Cervus canadensis nannodes)*. Summer daytime temperatures can exceed 100° F and winter temperatures can decline below freezing. Seeps, springs, and small ponds, which provide water for elk during summer may, affect elk distribution in some portions of the Unit.

The Unit consists of 418,000 acres at the southern limit of historical tule elk range as depicted by McCullough (1969). Approximately half of the Unit is private land used for livestock and agricultural production and recreation. The United States Department of Agriculture Forest Service (USFS; Los Padres National Forest) and the United States Department of Interior Bureau of Land Management (BLM; Bakersfield District) are the primary public land management agencies. Elk seldom use USFS and BLM land, but can be found on the 14,000 acre Bitter Creek National Wildlife Refuge managed by the United States Fish and Wildlife Service (USFWS) as roosting and foraging habitat for California Condors. Access to the Bitter Creek Refuge is prohibited, but the public can view wildlife from a road through the refuge. The Wildlands Conservancy, a private conservation organization, owns approximately 95,000 acres within the Unit that is used considerably by elk.

Elk Distribution and Abundance

The California Department of Fish and Wildlife (Department) initially focused on providing animals from diverse sources, and in numbers sufficient to reestablish tule elk within the Unit. In January of 1998, the Department released five sub-adult bulls and 15 cows from San Luis Refuge onto land owned by the Wildlands Conservancy. The Department has conducted four subsequent translocations to augment the initial effort: 1) in October 1999 three bulls and 34 cows from Concord Naval Weapons Station; 2) In February 2005, two bulls and 19 cows from San Luis Refuge; 3) In 2013, two adult bulls, two yearling bulls, and two cows from San Luis Refuge; 4) In March 2014, 15 cows and calves from San Luis Refuge. The elk have dispersed from the various release sites on Wildlands Conservancy's holdings, some as far away as 12 miles and generally occupy mid-elevations between 1,500 and 4,500 feet in southern Kern County. Wildlands Conservancy personnel monitor the elk within the Unit using ground counts. The current population estimate for the Unit is 350 animals (Table 1).

Management Goals, Objectives, and Actions

The management goals for this Unit are to: 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

In 2010, the Department evaluated an alternative to establish a public tule elk hunt within the Unit. The hunt was put on hold because public access opportunities were extremely limited; the Department will revisit the issue in the future. The Department expects that the elk population will continue to increase, as will the potential for private property conflicts. Regulated hunting remains the primary method of controlling population numbers and alleviating private property conflicts with elk. Population management for the Unit will involve a conservative level of regulated elk hunting to promote natural range expansion and population growth towards the upper population objective in areas without conflict, with focused elk hunting and depredation relief in areas with reoccurring agricultural or human conflicts.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The elk population is increasing and has not reached the upper population identified in Objective 1.6. Population management for this Unit involves efforts to increase elk numbers, where suitable, and regulated hunting in areas where conflicts occur.

Elk heavily utilize private lands, which, in some areas causes conflict with landowners. One method to increase elk populations is to expand their use of private lands where landowners tolerate them. Private lands where elk may be tolerated or encouraged include woodlands, ownerships enrolled in the Private Lands Management (PLM) program, and other properties where elk are desired by the landowner. Where such suitable, unoccupied elk habitat exists, management actions should facilitate natural dispersal to reestablish elk there.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. To achieve these objectives, the Department will collaborate with state and federal agencies, and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2023, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Initiate helicopter surveys (augmented as necessary with ground surveys conducted in cooperation with local landowners). Surveys should occur on a three-year rotation. Expected completion: 2021.

Action 1.1.2
Affix radio telemetry (GPS/VHF) collars on a sufficient sample size of elk to estimate seasonal range, individual groups, habitat use, movements, population connectivity, population demographics, assist with evaluating harvest strategies, and prioritize private land conservation values. Expected completion: 2023.

Action 1.1.3
Collaborate with academia, non-governmental organizations (NGOs), and others to collect population, distribution, and composition data in an effort to inform management decisions that would benefit elk. Expected completion: 2023.

Action 1.1.4
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle (UAV) surveys. Expected completion: 2023.

Objective 1.2. Increase elk populations by at least 10% where human-elk conflicts are expected to be minimal, by 2028.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and grazing techniques to benefit elk. Ongoing.

Action 1.2.3
Determine the distribution of water sources within the Unit and evaluate the feasibility of improving existing sources or establishing additional sources. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with USFWS, California Department of Forestry and Fire Protection, NGOs, and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Utilizing elk habitat and distribution data, work with state and federal agencies, and private landowners to identify specific areas for prescribed burns to benefit elk. Ongoing.

Action 1.3.4
Collaborate with academia to collect habitat use data to identify areas utilized by elk and recommend management actions that would enhance or increase acreage of these areas. Expected completion: 2023.

Action 1.3.5
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.6
Work with private landowners to improve forage conditions by planting grasses/forbs and providing mineral supplements. Ongoing.

Action 1.3.7
Coordinate with private landowners such as the Wildlands Conservancy on grazing strategies that enhance/maintain habitat values for elk in an effort to discourage elk dispersal onto adjacent private property to reduce human-elk conflicts. Ongoing.

Objective 1.4. Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease) by 2025.

Action 1.4.1
Collaborate with academia on mortality study and determine the feasibility of enlisting graduate students to assist in the project. Expected completion: 2023.

Objective 1.5. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.5.1
Department personnel shall collect DNA samples as opportunities arise (mortalities or as part of collaring activities). Ongoing.

Action 1.5.2
Distribute DNA collection kits to USFWS Bitter Creek National Wildlife Refuge and Wildlands Conservancy personnel for opportunistic submittal of DNA samples to map elk genetics across the Unit. Ongoing.

Action 1.5.3
Use genetic monitoring results and GPS collar data to identify and prioritize areas for potential translocations and habitat connectivity projects. Expected completion: 2023.

Objective 1.6. Maintain a population of 250-600 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.6.1
Provide bull and antlerless hunting opportunities at levels that allow for long-term expansion of the elk population and provide landowners with incentives to support having elk on their properties. Ongoing.

Action 1.6.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department will recommend establishing a hunt zone in this Unit to manage population numbers and provide opportunities for public use. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and methods of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success and, over time, elk population numbers and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take.

Combined with establishing a public hunt zone for the Unit, another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 2.1. Establish elk hunting opportunities that are compatible with population objectives by 2022.

Action 2.1.1
Complete a new elk hunting environmental document to evaluate hunting opportunities. Expected completion: 2020.

Action 2.1.2
Determine recommended harvest quotas that are compatible with population objectives and provide opportunities to the public. Expected completion: 2020.

Action 2.1.3
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Expected completion: 2022.

Objective 2.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.2.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

To date, human-elk conflicts in the Unit have been minimal. As the elk population approaches the maximum objective for the Unit, conflicts may increase and additional actions to control population numbers may become necessary. Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. The Department will design a hunting program to stabilize population numbers over the Unit (consistent with population objectives) and limit adjacent human-elk conflicts. Where substantial human-elk conflicts occur, elk population control, landowner incentives, non-lethal elk exclusion/deterrence tactics, and additional management actions may be implemented while maintaining a viable elk population.

The Department will emphasize use of regulated hunting to address chronic and/or large-scale elk depredation problems, where feasible. In areas where a hunting program is not feasible, the Department will work with landowners to implement non-lethal techniques such as fencing and hazing to help alleviate chronic elk depredation problems. Combining elk hunting opportunity with issuance of depredation permits is possible if hunting and other methods to alleviate the conflict are not successful.

Objective 3.1. Continue to monitor reports of human-elk conflicts on private property.

Action 3.1.1
Map areas of human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk.
Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation.
Ongoing.

Herd Viability

Elk were reestablished within the Unit over 19 years ago. In total, 99 tule elk were released within the Unit from two separate sources: the San Luis National Wildlife Refuge and Concord Naval Weapons Station. The Department will likely adjust the upper population threshold in the future based on biological factors and/or human tolerance for tule elk as indicated by private property conflicts.

The La Panza Tule Elk Management Unit is adjacent to and immediately northwest of the San Emigdio Mountains Unit. It is possible for the exchange of individuals between these units to occur and monitoring to detect such movements may be warranted. Additionally, the 270,000-acreTejon Ranch is adjacent to the eastern boundary of the Unit and supports a small population of Rocky Mountain elk (*C. c. nelsoni*). Suitable elk habitat within the Tejon Ranch is separated from occupied tule elk habitat within the Unit and movement of individuals between both areas is unlikely. However, continued monitoring of elk distribution and movements is warranted in both areas.

Summary of Annual Harvests

Public elk hunting currently does not occur within the Unit, and the Department has received no applications to hunt elk through the PLM program. Public elk hunting occurs within the adjacent La Panza unit, but harvest within that unit has no impact on population numbers of the San Emigdio Mountains Unit due to no detected movement of elk across Unit boundaries. The Department will reevaluate the feasibility of a public hunt in the future. Additionally, private landowners within the Unit may elect to participate in programs to hunt elk.

Unit Highlights

The Department has cooperated with the USFWS and the Wildlands Conservancy in monitoring and managing elk within the Unit.

Literature Cited:

California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

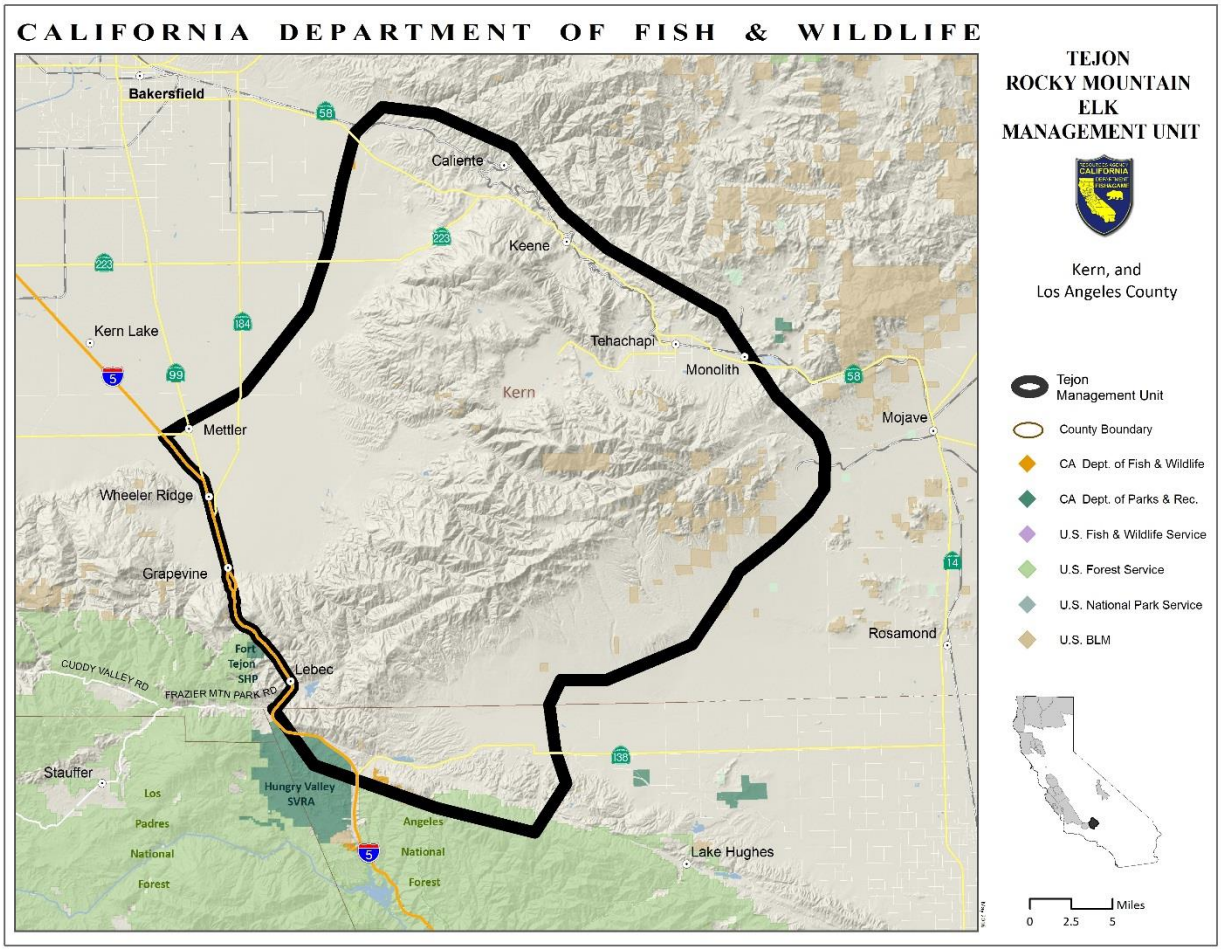
McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Data Tables/Figures

Table 1. Tule Elk Ground Surveys for the San Emigdio Unit.
(Conducted by Wildlands Conservancy personnel)

Year	Bulls	Cows	Calves	Unknown	Total
1998	5	15			20
2000	5	20	4		29
2004	22	50	24		96
2005	26	56	33		115
2006	54	55	18		127
2007	71	154	46		271
2008	44	93	36		173
2009	56	104	36		196
2010	53	82	28		163
2011	58	137	50		245
2012	57	105	21		183
2013	65	160	39		264
2014	109	213	41		363
2016	17	58	20	14	109

Tejon Rocky Mountain Elk Management Unit



Tejon
Rocky Mountain Elk Management Unit

Description

The Tejon Rocky Mountain Elk Management Unit (Unit) spans approximately 636,822 acres in portions of Kern and Los Angeles counties. The Unit contains property owned/managed by the Tejon Ranch Company and adjacent property, that extends east for about 25 miles from Interstate Highway 5. The Unit is generally bounded to the west by Interstate Highway 5, to the south by Highway 138 in Los Angeles County, and to the north by Highway 58.

The Unit is within portions the Central Valley and Sierra Nevada, South Coast, and the Deserts Provinces, as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015).The Unit includes a portion of the Transverse Range that forms the southern wall of the San Joaquin Valley and links the Temblor Range with the Tehachapi Mountains. Summer daytime temperatures can exceed 100° F and winter temperatures can decline below freezing. The Rocky Mountain elk (*Cervus canadensis nelsoni*) that inhabit the Unit use elevations from 3,000 to 8,000 feet. Seeps, springs, and small ponds provide water for elk, and water availability during summer may affect elk distribution in some portions of the Unit. The area is at the southern limit of historical tule elk (*C. c. nannodes*) range (McCullough 1969), and well outside of historical Rocky Mountain elk range.

The Tejon Ranch Company comprises the majority of elk use within the Unit and is privately-owned by its stockholders. The property is used for farming, livestock grazing/production, real estate, and various commercial purposes, including oil and mineral production. Recreational activities that involve hunting and fishing are offered on a fee basis. The Tejon Ranch Company controls public access to their property and recreational activities involving elk include hunting, photography, viewing, and nature study.

Elk Distribution and Abundance

In 1966, Mr. Rex Ellsworth received a permit to import Rocky Mountain elk from Yellowstone National Park to a fenced compound on his ranch approximately 10 miles southwest of Tehachapi in Kern County. In April of 1967, 290 elk were shipped and 277 were released into a compound under provisions of a domesticated game breeder's license. Mortalities from capture stress, transport, and confinement were significant, and elk soon escaped due to a lack of fence maintenance. In September of 1967, California Department of Fish and Wildlife (Department) personnel reported that 110-125 elk had died, approximately 30 remained within the compound, and 40-60 elk were unaccounted. The Department did not renew the domesticated game breeder's license

in 1968. Although 24 elk re-entered the compound and were captured in 1968, an unknown number had escaped into free-ranging conditions on the nearby Tejon Ranch. Subsequent legislation passed in 1979, and Fish and Game Code (FGC) 2118 et. seq. now prohibits importing elk into California and the removal or sale of their antlers for commercial purposes.(FGC §. 2118.2, 2118.3, and 2118.4).

Thomas (1975) speculated that nearly 100 elk were distributed throughout the Tehachapi Mountains in 1974 and reported that adjacent landowners generally favored having elk in the area. Table 1 summarizes elk population surveys conducted by Tejon Ranch personnel from 1984-2014. The current population estimate for the Unit is 300 animals. Non-hunting mortality factors have not been investigated in detail, but likely include predation, disease, and (at least initially) poaching.

In February of 1978, seventeen tule elk were released in a holding pen near Jawbone Canyon, where they were to remain confined for six months prior to release within a larger 3,000 acre enclosure (Bureau of Land Management 1979). Jawbone Canyon is approximately 10 miles northeast of Highway 58 and the Tehachapi Pass in Kern County. Most of the elk escaped from the holding pen or died, but the small number that remained were released from the holding pen in late 1978. Observations of tule elk near Jawbone Canyon were very limited over the next several years and the initial release was not augmented with additional animals. In 1986, the Tule Elk Interagency Task Force determined that there was little potential for elk to persist in the Jawbone Canyon area, and that this tule elk herd would not be viable in future reports (Bureau of Land Management 1986).

Management Goal, Objectives, and Actions

The management goals for this Unit are to: 1) Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change; 2) enhance opportunities for public use and enjoyment of elk that includes hunting and wildlife viewing; and 3) alleviate human-elk conflicts. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Private land is essential to the survival of elk within the Unit. There is a potential for agricultural/private property conflicts with elk, thus the current population management strategy utilizes hunting through the Private Lands Management (PLM) program to provide landowners an incentive to accommodate the needs of elk. The current harvest strategy has not yet emphasized controlling population numbers, as private property conflicts to date have been minor. Cumulative harvests have consisted primarily of bulls and the current level of regulated hunting has not adversely affected elk population numbers. Harvest levels should be implemented which maintain the population and reduce the possibility of hybridization with tule elk in adjacent units. Possible modifications and future harvest strategies will be considered if elk distribution expands

beyond land owned by the Tejon Ranch. These strategies could involve establishing a public hunt zone.

Goal 1. Increase elk habitat and populations and ensure elk are an integral part of a functioning ecosystem within habitat capacity and in consideration of other land uses and long-term environmental change.

The Department considers the elk population to be stable. Population management for this Unit involves efforts to maintain elk numbers where suitable habitat exists and prevent hybridization with tule elk in adjoining units. The current strategy utilizes hunting through the PLM program to alleviate conflicts and provide landowners an incentive to accommodate the needs of elk.

Enhancing early seral vegetation is critical to increasing elk populations. Disturbances such as fire or habitat improvement projects promote a mix of habitat types and successional stages, including forest openings that benefit elk. Elk heavily utilize private lands, which in some areas may cause conflict with landowners. Management objectives emphasize maintaining existing elk populations and not expanding the current population beyond the existing areas of use. To achieve these objectives, the Department will collaborate with state and local agencies and private landowners.

Objective 1.1. Estimate population abundance, distribution, habitat use, and demographics by 2024, to provide managers with additional information to make adaptive management decisions.

Action 1.1.1
Coordinate with the Tejon Ranch to continue ground surveys. Ongoing.

Action 1.1.2
Evaluate the feasibility of utilizing aerial surveys to augment ground counts (surveys should be on a three-year rotation). Expected completion: 2022.

Action 1.1.3
Develop innovative technologies to estimate population parameters such as fecal DNA and unmanned aerial vehicle surveys. Expected completion: 2023.

Objective 1.2. Maintain elk populations where human-elk conflicts are expected to be minimal.

Action 1.2.1
Map habitat that can support elk and overlay with areas currently reporting human-elk conflicts to identify areas of potential management actions. Expected completion: 2022.

Action 1.2.2
Coordinate with public land agencies and private landowners to identify habitat enhancement projects and grazing techniques to benefit elk. Ongoing.

Action 1.2.3
Work with land agencies, Tejon Ranch, and other private landowners to develop and improve water sources, remove potential lethal hazards (e.g., old fencing), and install fence crossing structures. Expected completion: 2022.

Objective 1.3. Enhance or increase elk habitat by at least 5% by 2028.

Action 1.3.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 1.3.2
Meet annually with local agencies, California Department of Forestry and Fire Protection, non-governmental organizations (NGOs), and private landowners to identify opportunities to conserve and enhance elk habitats. Ongoing.

Action 1.3.3
Participate in landscape level planning efforts, to the extent possible, to identify potential impacts and make recommendations that would benefit elk and elk habitats. Ongoing.

Action 1.3.4
Provide PLM operators with a list of specific habitat enhancement recommendations for elk during annual inspections. On subsequent visits, Department staff will evaluate and provide feedback on the effectiveness of habitat enhancement efforts and suggest necessary improvements. Ongoing.

Objective 1.4. Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies, by 2023.

Action 1.4.1
Distribute DNA collection kits to Tejon Ranch elk hunters for submittal of DNA samples to evaluate genetics. Ongoing.

Action 1.4.2
Collect DNA samples as opportunities arise (mortalities or as part of management activities). Ongoing.

Objective 1.5. Maintain a population of 150-350 elk with a minimum ratio of 25 bulls per 100 cows.

Action 1.5.1
Continue hunting through the PLM program and provide bull and antlerless hunting opportunities at levels that limit expansion of the elk population. Ongoing.

Action 1.5.2
Review monitoring, management, and research data on an annual basis and adjust population objectives as appropriate. Ongoing.

Goal 2. Enhance opportunities for public use and enjoyment of elk that include hunting and wildlife viewing.

The Department will continue to work with conservation partners to inform the public about elk and elk management within the Unit, and promote various recreational opportunities such as hunting, wildlife viewing, photography and nature study.

The Department has identified regulated hunting as the primary tool to both manage elk populations and provide public recreation opportunities. Through regulations, hunting can influence elk distribution and population parameters. Timing and duration of hunt periods, hunt boundaries, tag designations (i.e., bull, antlerless or either-sex tags), quotas, and method of take (e.g., general methods, archery only, muzzleloader only) can affect hunter success, elk population numbers, and age/sex compositions within the Unit. The quality and quantity of elk demographic data and desires for hunter opportunity are other considerations in recommending and/or adopting elk hunting regulations. Each year, the Department considers modifications to hunt zone boundaries, tag quotas, hunt periods, and methods of take.

Another potential recreational and population management strategy involves the Shared Habitat Alliance for Recreational Enhancement (SHARE) program. Under this program, participating landowners receive compensation and liability protection in exchange for allowing access to (or through) their land for public recreational use and enjoyment of wildlife. The SHARE program receives funding from application fees for access permits.

Objective 2.1. Establish elk hunting opportunities outside of the existing PLM, where compatible with population objectives, by 2023.

Action 2.1.1
Evaluate the feasibility of establishing a public elk hunt within the management unit. Expected completion: 2020.

Action 2.1.2
Complete a new elk hunting environmental document to evaluate additional hunting opportunities. Expected completion: 2020.

Action 2.1.3
Utilize SHARE to increase elk hunting opportunities and address human-elk conflicts on private property. Expected completion: 2022.

Objective 2.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 2.2.1
Work with agencies and NGOs to provide information on elk and elk viewing. Expected completion: 2020.

Goal 3. Alleviate human-elk conflicts and elk depredation complaints.

To date, human-elk conflicts have been minimal. If the elk population approaches the maximum objective for the Unit, additional actions to control population numbers may become necessary. Periodic complaints have involved competition with livestock for forage and fence damage. The PLM program has provided an incentive for Tejon Ranch to accommodate elk within the Unit. If future changes in elk densities or distribution escalate depredation conflicts, a more liberal harvest strategy could be implemented.

Controlling population numbers and damage/land use conflicts with regulated hunting may become more challenging because of the prevalence of private land within the Unit. The SHARE program is a potential population management strategy that can improve public access to private (or landlocked public) land. The SHARE program may also assist in controlling elk population numbers and managing damage/land use conflicts that involve elk on private land.

Regulated hunting provides valid recreational opportunities and can assist landowners with human-elk conflicts. Where substantial human-elk conflicts develop, non-lethal elk exclusion/deterrence tactics may also be implemented to reduce conflicts. Finally, the Department may issue depredation permits when readily identifiable animals cause property damage.

Objective 3.1. Continue to monitor human-elk conflicts on private property.

Action 3.1.1
Map areas of human-elk conflicts and assess potential for alleviating damage by stabilizing localized elk populations through regulated hunting, where feasible. Ongoing.

Action 3.1.2
Collaboratively develop best management practices (BMPs) designed to alleviate conflicts. Expected completion: 2021.

Action 3.1.3
Document and continue to respond to human-elk conflicts and provide the reporting party a list of preventative techniques and actions to alleviate conflict, including BMPs (once established). Ongoing.

Action 3.1.4
Collaborate with United States Department of Agriculture Wildlife Services and the Department's Office of Communication, Education, and Outreach to develop and distribute information pamphlets to increase awareness of nonlethal techniques to reduce damage caused by elk. Expected completion: 2022.

Action 3.1.5
Issue elk depredation permits consistent with statute, regulation, and Department policy at locations experiencing substantial elk depredation. Ongoing.

Herd Viability

Rocky Mountain elk have been established in portions of the Tejon Ranch for 50 years. Elk numbers appear generally stable, but local fluctuations have been observed. The herd is isolated from other Rocky Mountain elk. The potential for hybridization with tule elk from the San Emigdio Mountains unit currently is minimal as Interstate Highway 5 is an apparent barrier to movement. Continued monitoring of elk distribution is warranted within both the San Emigdio Mountains and Tejon units to ensure that a barrier to movement continues.

Summary of Annual Harvests

The Fish and Game Commission (FGC) authorized public elk hunting within the Tejon Ranch with special drawing hunts that occurred in 1978, 1983, and 1984. The Tejon Ranch was an initial participant when PLM began as a pilot program in 1981, and has since participated annually. Although the FGC authorized elk tags through the PLM Program from 1985-1987, the Tejon Ranch chose not to issue such tags until 1988. Annual reported elk harvests for the Tejon Ranch 2008-2016 are summarized in Table 2.

Unit Highlights

Rocky Mountain have persisted within the Tejon Unit for over 50 years. The herd originally was imported into California to remain confined within a compound under provisions of a domesticated game breeder's license. Presently, the herd is healthy and a geographic barrier appears to prevent hybridization with tule elk; thus there is no biological or social basis to extirpate this herd. Below is a partial listing of management activities undertaken and accomplishments within the Unit:

- Thomas (1975) reported on the status of Tejon Ranch elk.
- Beginning in 1978, the Fish and Game Commission authorized three special elk hunts at the Tejon Ranch.

A partial listing of studies, reports and monitoring/management activities within the Unit is as follows:

Unit Specific Research

Thomas, R.D. 1975. The status of Rocky Mountain Elk in Kern County, 1974. California Fish and Game 61(4):239-241.

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Bureau of Land Management. 1979. The tule elk in California; 3rd annual report to congress. Bureau of Land Management, Sacramento, California, USA.

Bureau of Land Management. 1986. The tule elk in California; 8th annual report to congress. Bureau of Land Management, Sacramento, California, USA.

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FGC § 2118.2.

FGC § 2118.3.

FGC § 2118.4.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Thomas, R.D. 1975. The status of Rocky Mountain Elk in Kern County, 1974. California Fish and Game 61(4):239-241.

Data Tables/Figures

Table 1. Tejon Ranch Private Lands Management Elk Survey Results 1995-2014.

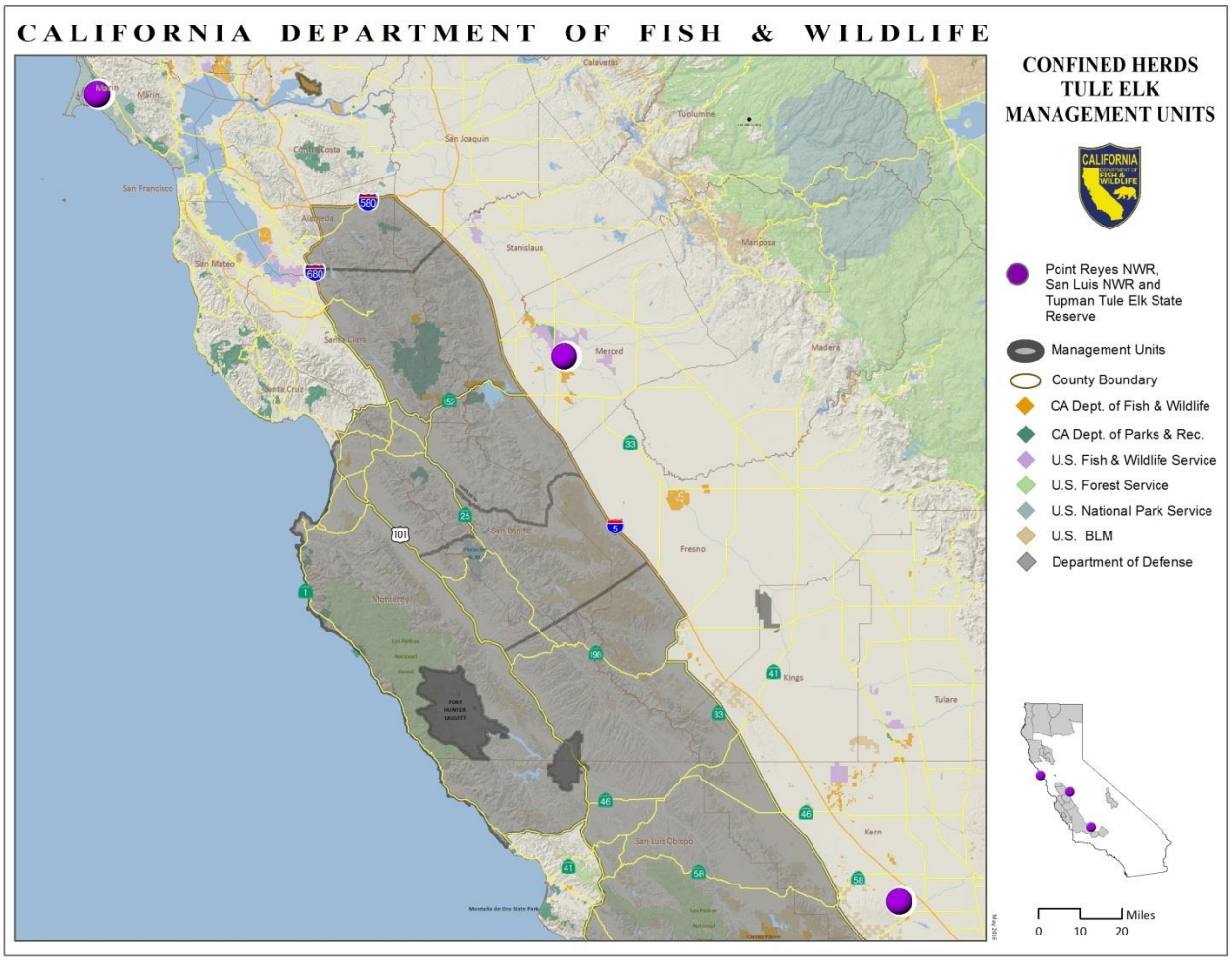
Year	Bulls/100 Cows	Calves/100 Cows	Total
1995	53	47	**68**
1996	83	44	**82**
1997	85	45	**143**
1998	73	41	**137**
1999	71	48	**162**
2000	68	38	**142**
2001	74	40	**164**
2002	78	37	**139**
2003	68	42	**156**
2004	74	38	**142**
2005	72	39	**163**
2006	54	28	**190**
2007	58	31	**173**
2008	51	29	**124**
2009	38	30	**261**
2010	42	40	**307**
2011	40	44	**320**
2012	58	39	**302**
2013*	57	7	**135**
2014*	19	42	**137**

*Conducted in winter, all other surveys conducted in fall.

Table 2. Tejon Ranch Private Lands Management Area Annual Elk Harvest 2008-2016.

Year	Bulls	Antlerless
2008	5	0
2009	3	0
2010	7	0
2011	8	0
2012	6	0
2013	10	1
2014	9	1
2015	7	1
2016	9	2

Confined Herds Tule Elk Management Unit



Confined Tule Elk Herds:
Tupman Tule Elk State Reserve, San Luis Refuge and Point Reyes National Seashore at Tomales Point

Description

Confined (enclosed by an elk proof fence) tule elk (*Cervus canadensis nannodes*) herds currently are maintained at the Tupman Tule Elk State Reserve (Tupman) in Kern County, San Luis National Wildlife Refuge (San Luis Refuge) in Merced County, and Point Reyes National Seashore at Tomales Point (Tomales Point) in Marin County. Tupman and San Luis Refuge are within the Central Valley and Sierra Nevada Province, and Tomales Point is within the North Coast and Klamath Province as identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015). All are within historical tule elk range as depicted by McCullough (1969), and are described in in detail below.

The 685-acre Tupman enclosure is approximately 20 miles southeast of Bakersfield, on property managed by the California Department of Parks and Recreation (CDPR). Topography is flat, and climate and vegetation are typical of the southern San Joaquin Valley. With limited riparian and marsh vegetation, habitat conditions are poor during late summer and fall, especially in a dry year when much of the enclosure is bare ground. Other large herbivores are absent within the enclosure and uncommon nearby.

The San Luis Refuge herd is within a 761 acre fenced enclosure, approximately five miles north of Los Banos, managed by the United States Fish and Wildlife Service (USFWS). Topography is flat and habitat is a mixture of valley grassland and riparian types. Other large herbivores are uncommon, but include black-tailed deer (*Odocoileus hemionus)* and domestic sheep near the enclosure.

The Tomales Point herd inhabits 2,600 acres at the northern end of Tomales Point, approximately 40 miles north of San Francisco. Elk cannot disperse to the east, north, and west due to the presence of Tomales Bay, Bodega Bay, and the Pacific Ocean. A fence that runs from Tomales Bay to the Pacific Ocean prevents dispersal to agricultural areas to the south. Tomales Point is part of Point Reyes National Seashore, managed by the United States National Park Service (NPS). Terrain varies from gently rolling to precipitously steep hills and canyons. Open grasslands, shrub dominated grasslands, and dense scrub with 70-100% shrub cover are predominant. Other large herbivores at or near Tomales Point include black-tailed deer, axis deer (*Axis axis*), fallow deer (*Dama dama*), and domestic cattle (*Bos taurus*).

A fourth confined herd once existed at Concord Naval Weapons Station (CNWS) in Contra Costa County from 1977-2006. This herd was surrounded by residential development and the Sacramento River/Suisun Bay, which prevented its dispersal and

range expansion. Public access was restricted and considered incompatible with the primary use of the area for storage/transport of weapons and munitions. In 2006, the California Department of Fish and Wildlife (Department) removed all elk from CNWS to augment other existing herds.

Public access and recreational opportunities are excellent as the confined herds are managed by state and federal agencies (hunting and antler collecting are prohibited). Access inside the Tupman and San Luis Refuge enclosures is prohibited, but a tour route exists around the perimeter fence at the San Luis Refuge, and both enclosures have viewing platforms and interpretive displays. Pierce Point Road, which ends in a parking lot at Pierce point Ranch, provides access to Tomales Point. Elk are readily visible from a hiking trail that extends north from the parking lot for approximately five miles, as well as from boats on Tomales Bay.

Elk Distribution and Abundance

Intensive agricultural operations are adjacent to each of these herds. The Buttonwillow herd damaged crops and fences until it was moved into the Tupman enclosure in 1932 (McCullough 1969). Confining the elk resolved agricultural conflicts and prevented their extirpation. In the 1970s, the historical Buttonwillow resolution shaped decisions to place elk into enclosures at San Luis Refuge and Tomales Point (McCullough 1969). Confining elk was regarded as the only way to respect landowner rights and mitigate the economic threat to agricultural operations on private land within Merced and Marin counties.

Major highways exist near the confined herds at Tupman and San Luis Refuge. California State Route 165 is a rural highway, within a few miles of the San Luis Refuge which connects Interstate Highway 5 to State Route 99 for transport of agricultural products and manufactured goods. The Tupman enclosure is located a few miles west of Interstate Highway 5, the major west coast transportation thoroughfare. These thoroughfares are primary factors for keeping the Tupman and San Luis herds remain confined.

In 1932, the State Park Commission purchased the Tupman Reserve. Upon construction of a perimeter fence, the Buttonwillow herd was moved into the enclosure. Tule elk habitat initially was good and regular flooding maintained riparian and marsh vegetation. Subsequent water management projects such as the Buena Vista Canal and construction of Isabella Dam, have reduced inundation and caused riparian vegetation to deteriorate, so supplemental feeding became necessary [McCullough 1969, United States Department of Interior Bureau of Land Management (BLM) 1992]. Although habitat improvement projects have been completed (Bureau of Land Management 1992), riparian and marsh vegetation remain inadequate, and habitat conditions are marginal.

Initial parcels for the San Luis Refuge were purchased with Federal Duck Stamp funds in 1966, and were noteworthy as the last expanse of unplowed native valley bottomland

in California (Fowler 1985). In 1974, eighteen tule elk from the San Diego Wild Animal Park were released within the enclosure. The San Luis Refuge has since expanded to more than 26,000 acres, but elk remain confined to the initial enclosure because of potential highway conflicts and depredation conflicts on private land. Much of the San Luis Refuge is inundated, and riparian/marsh vegetation is good.

Point Reyes National Seashore was established by federal legislation in 1962, and currently encompasses approximately 71,000 acres. In 1976, Congress designated approximately 33,000 acres of the seashore, including Tomales Point, as wilderness, later naming it the Phillip Burton Wilderness. In March 1978, the Department placed two bulls and eight cows from the San Luis Refuge into a temporary holding pen at Tomales Point. Historically, Tomales Point was heavily grazed by cattle. To prevent competition and minimize depredation conflicts, the existing cattle were to be removed from the enclosure prior to reintroduction of elk, and an elk-proof fence was to be built to confine the elk within the northernmost 2,600 acres at Tomales Point. Upon completion of the fence, a legal dispute arose over grazing rights. At that point, elk mingled with domestic cattle for over a year until the dispute was resolved and cattle were removed from the Tomales Point enclosure.

The current population estimate for all three of the confined herds (Tupman, San Luis Refuge, and Tomales Point) is 400 animals.
Table 1 contains historical population numbers for Tupman, based on Fowler (1985) and periodic surveys by CDPR staff. The maximum population objective for Tupman is 30-32 elk, but population size has exceeded this objective on numerous occasions.

Table 2 contains historical population numbers for the San Luis Refuge, based on periodic surveys by USFWS and California Department of Fish and Wildlife (Department) personnel. The desired objective for the San Luis Refuge is 40-50 elk. As with Tupman, population size has periodically exceeded this objective.

Tables 3 and 4 contain population survey results for Tomales Point and Point Reyes National Seashore, based on Gogan (1986) and surveys by NPS staff.

Elk population objectives for Tomales Point have changed over time. The initial objective was 300 animals “until proposed studies provide additional data” (Bureau of Land Management 1979, National Park Service 1982). Fowler (1985) dissented with this objective and supported a density of 10 elk per square mile (equivalent to 41 elk); this was similar to the density objective for Grizzly Island. Gogan (1986) estimated the elk carrying capacity at Tomales which varied from 90 elk based on vegetation biomass, to 350 elk (based on livestock equivalency). Gogan (1986) recommended basing population management decisions on an objective threshold of 140 elk. Between 2012 and 2015, the population at Tomales Point declined by approximately 50%, dropping from 540 to 283.
The loss of animals is believed to be related to drought conditions, mineral deficiencies, and the population level above carrying capacity within the enclosure.

In 1993, NPS convened a panel of experts to provide elk management recommendations. This eventually culminated in completion of the Point Reyes National Park Seashore Tule Elk Management Plan and Environmental Assessment in 1998. Recommendations within this plan included the following: continue testing experimental contraception (initiated in 1997) to limit population growth at Tomales Point; establish a free-ranging elk herd within Point Reyes National Seashore; and use minimal management intrusion to maintain populations within management limits based on threshold indicators.

In December 1998, 45 tule elk were moved from Tomales Point to a holding pen near Limantour Beach within the Philip Burton Wilderness and tested repeatedly for Johne's disease (individuals that tested positive were culled). Six months later, Department staff released 28 elk to free roaming conditions within Point Reyes National Seashore.

Management Goals, Objectives, and Actions

In 1979, a statewide tule elk management plan was prepared by the Tule Elk Interagency Task Force with an overall goal "to ensure the continued growth of healthy, free-roaming tule elk herds of sizes that are ecologically compatible with the suitable habitats of California." The document also contained specific short term and long-term objectives and policies regarding the reintroduction and management of tule elk.

The management goals for the confined herds are to: 1) reduce the number of confined herds and reduce the frequency for removing excess animals; 2) enhance habitat within enclosures; and 3) enhance opportunities for public use and enjoyment of elk that includes wildlife viewing and education. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. <u>Reduce the number of confined herds and the frequency for removing excess animals.</u>

Tule elk herds have been reestablished throughout suitable historical habitat in California, and recovery objectives of state and federal legislation during the 1970s have been attained. Confined herds once provided a convenient source of stock for reintroduction. Although these herds continue to provide opportunities for public viewing and education, artificial conditions associated with their confinement are undesirable in the long term. The Department should shift objectives to emphasize managing tule elk in a free-roaming state to the maximum extent possible, as specified in the Management Plan for the Conservation of Tule Elk (Tule Elk Interagency Task Force 1985). The Tupman and San Luis herds occupy relatively small areas at relatively high densities. Suitable adjacent habitat for dispersal may be limited in perpetuity by agricultural development and the potential for highway conflicts. Although each confined herd exists within historical tule elk range, their captive-habitat conditions likely preclude reaching or maintaining optimal population levels that promote long-term population viability and genetic diversity without jeopardizing habitat conditions.

Although poaching incidents and natural mortalities have occurred within confined herds, recruitment still exceeds mortality. In the absence of regulated elk hunting, capture and translocation of surplus elk to other locations has been the primary population management strategy for confined herds at Tupman and San Luis Refuge. Other strategies have been used to reduce the frequency of translocation projects, including culling, contraception, and manipulation of sex ratios to reduce the number of reproducing females.

For Tomales Point, elk reproduction initially was low and total numbers remained relatively stable (Table 3). Tomales Point elk were copper-deficient, based on analysis of liver, serum and hair samples (Gogan 1986). Additionally, Johne's disease caused by *Mycobacterium paratuberculosis*, was diagnosed in Tomales Point tule elk (Jessup et al. 1981). Found also in domestic livestock and free-ranging axis and fallow deer at Point Reyes, Johne's disease was fatal to individual elk and initially suppressed population growth (Gogan 1986). It is highly infectious and potentially damaging to livestock and wild ungulates. Clinical symptoms included diarrhea, severe debilitation, and weight loss. Although techniques have advanced since 1981, diagnosis remains cumbersome and unreliable, and non-lethal treatments are not available.

The absence of reliable diagnostic and treatment techniques for Johne's disease has eliminated using capture and translocation to control elk population numbers at Tomales Point. Moving diseased or otherwise contaminated animals is contrary to the Management Plan for the Conservation of Tule Elk (1985), the current elk management plan, and the Department's elk relocation criteria. NPS conducted contraception trials from 1997-2002. NPS has emphasized minimal management intervention and population control strategies (including contraception). Whether long-term intervention will be needed to control elk population numbers remains unknown. Panel recommendations from 1993 called for agency culling if other strategies proved unfeasible or were rejected. However, specific vegetation management thresholds have not been established and public opposition to agency culling will likely be high.

<u>Objective 1.1. Eliminate one or more confined herds by 2025.</u>

Action 1.1.1
Evaluate the feasibility of releasing animals to free-roaming conditions on adjacent land, or moving animals to establish new herds, or augment existing herds in an effort to eliminate an enclosure. Expected completion: 2023.

Action 1.1.2
Evaluate the feasibility of combining the Tupman and San Luis Refuge herds. Expected completion: 2023.

Objective 1.2. Reduce population levels within enclosures and identify preferred population control methods by 2025.

Action 1.2.1
Coordinate with CDPR, USFWS, and NPS to evaluate the feasibility of population control mechanisms to reduce frequency of removing animals that are above the enclosure objectives. Expected completion: 2023

Goal 2. Enhance habitat within enclosures.

Elk within confined herds rely on a limited area of use to acquire yearlong nutrition. Habitat conditions within enclosures should be enhanced to provide a healthy environment for elk.

Objective 2.1. Enhance elk habitats by at least 5% by 2028.

Action 2.1.1
Map current elk habitat to detect change over time and guide management decisions. Expected completion: 2021.

Action 2.1.2
Meet annually with CDPR, USFWS, and NPS to identify opportunities to enhance elk habitats. Ongoing.

Action 2.1.3
Work with NPS to identify/establish specific vegetation management thresholds for Tomales Point. Expected completion: 2021.

Action 2.1.4
Continue to work with NPS to determine the prevalence of Johne's disease within tule elk at Tomales Point, as well as the free-roaming herd. Ongoing.

Goal 3. Enhance opportunities for public use and enjoyment of elk that include wildlife viewing and education.

The Department will continue to take advantage of opportunities to inform the public about elk within the Unit and promote various recreational opportunities such as wildlife viewing, photography, and nature study. The Department will continue to work with conservation partners to provide information on elk and elk management to the public.

Objective 3.1. Increase elk viewing and educational opportunities by 20% by 2023.

Action 3.1.1
Coordinate with CDPR, USFWS, and NPS to determine baseline elk viewing visitor usage. Expected completion: 2020.

Action 3.1.2
Set up display booth and participate in tule elk days at San Luis National Wildlife Refuge. Ongoing.

Action 3.1.3
Coordinate with CDPR, USFWS, and NPS to participate in educational talks. Ongoing.

Objective 3.2. Provide information on the Department web page to inform the public about elk and elk viewing opportunities by 2020.

Action 3.2.1
Work with agencies and non-governmental organizations (NGOs) to provide information on elk and elk viewing. Expected completion: 2020.

Herd Viability

By 1870, tule elk in the Buttonwillow herd in Kern County were the last free-roaming tule elk remaining. Conditions from 1870-1932 became increasingly confining as agricultural development intensified in the southern San Joaquin Valley, and the herd has now been enclosed within fencing at Tupman for more than 80 years. The San Luis Refuge has supported tule elk for almost 40 years, and Tomales Point has supported them for 35 years. Tule elk from other locales have been added to the confined tule elk herds to facilitate genetic diversity and herd viability. In 1987, five bulls and five cows from the Detroit Zoo were released at Tupman and San Luis Refuge; in 1981, three bulls from the Owens Valley were released at Tomales Point; and in 2013, one adult female from San Luis Refuge was released at Tupman. The extent to which bulls mixed with the established herds is unknown, however, it is important to note that all tule elk are ultimately descended from the Buttonwillow stock. Confined herds provide surplus animals for reintroduction or improving genetic diversity/viability of established herds, but the surplus exceeds levels needed for reintroduction and diversity/viability.

Unit Highlights

The enclosures at Tupman and San Luis Refuge served to conserve tule elk and provided important sources of surplus stock to reestablish tule elk in California.

- From 1978-2015, approximately 400 tule elk were moved from San Luis Refuge and Tupman to reestablish and augment herds in California.

- From 2005-2007, staff at the Department, USFWS, and University of California at Davis investigated the possibility of establishing free range tule elk in the Grasslands Wildlife Management Area (in Merced County).

Unit Specific Research

A partial listing of studies, reports and monitoring/management activities within the Unit is as follows:

Burtch, L.A. 1934. The Kern County elk refuge. California Fish and Game 20(2):140-147.

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Greco, S. and P. Huber. 2007. Feasibility investigation (Phase 1): free-ranging tule elk in the Grasslands Wildlife Management Area, Merced County, California. LDA: tule elk GIS corridor model. Final report to the wildlife health center. University of California, Davis, USA.

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Shideler, S.E., M.A. Stoops, N.A. Gee, J.A. Howell, B.L. Lasley. 2002. Use of porcine zona pellucida (PZP) vaccine as a contraceptive agent in free-ranging tule elk (*Cervus elaphus nannodes*). Reproductive Supplement 60:169-176.

Tule Elk Interagency Task Force. 1979. The management plan for the conservation of tule elk.

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California Department of Fish and Wildlife. 2015. California state wildlife action plan, 2015: a conservation legacy for Californians. Edited by Armand G. Gonzales and Junko Hoshi, Ph.D. Prepared with assistance from Ascent Environmental, Inc., Sacramento, California, USA.

Fowler, G.S. 1985. Tule elk in California: history, current status and management recommendations. Project report for contract No. 83/84-C-698. Department of Forestry and Resource Management, University of California Berkeley, USA.

Gogan, Peter J.P. 1986. Ecology of the tule elk range, Point Reyes National Seashore. Dissertation, University of California, Berkeley, USA.

Jessup, D.A., B. Aggas, D. Behymer, and P. Gogan. 1981. Paratuberculosis in tule elk in California. Journal of the American Veterinary Medical Association 179:1252-54.

McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

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Tule Elk Interagency Task Force. 1985. A management plan for the conservation of tule elk. US Bureau of Land Management. Sacramento, California, USA.

Data Tables/Figures

Table 1. Tupman Tule Elk State Reserve, Population History and Survey Results.

Year	Number of Elk Counted					Removed
	Bulls	Cows	Calves	Unknown	**Total**	
1932				140	**140**	
1935				112	**112**	28 to Owens Valley
1947	50	58	14		**122**	
1948	50	58	7	?	**?**	
1949	50	58	2	?	**?**	
1950	44	27	2		**73**	9 to "parks"
1951				35	**35**	Approximately 40
1971					**about 32**	
1973	19	15	9		**43**	
1977				60	**60**	
1978			17	57	**73**	43
1979	17	12	11		**40**	
1980	16	12	24		**52**	
1981*	22	26	13		**61**	
1982	24	37	10		**71**	
1983*	29	41	14		**84**	53 to var. locations
1984	17	11	8		**36**	
1985	13	13	8		**34**	
1986	13	11	8		**32**	13 to Covelo
1987*	16	15	7		**38**	
1988	21	17	11		**49**	
1989				23	**59**	36 to La Panza
1990				21	**21**	2 to Fresno Zoo
1991						1 to La Panza, 2 to Mendocino
1992				22	**22**	
1993						1 to Parkfield
1995				30-35	**30-35**	
1996						9 to Cache Creek
1998						10 to West. Merced, 7 to Cache Creek
2007						38 removed, Chimineas Ecologal Reserve and Grizzly
2016			1	24	**25**	

No surveys 1998-2015.

Sources: Fowler, 1985; Calif. Dept. Pks & Rec. Tupman Tule Elk Reserve files; BLM Reports to Congress (various); DFG Reports to Legislature (various); CDFW relocation files.

* in 1981, two yearling males were added from the Owens Valley;
* in 1983, two yearling males were added from the Fresno Zoo;
* in 1987, five bulls were added from the Detroit Zoo.

Table 2. San Luis National Wildlife Refuge, Population History and Survey Results.

Year	Number of Elk Counted					Translocated/Removed
	Bulls	Cows	Calves	Unknown	Total	
1974	13	8	4		**25**	
1975			7	18	**25**	
1976			10	22	**32**	
1977			3	39	**42**	
1978			7	28	**35**	10
1979			5	17	**22**	20
1980			7	20	**27**	
1981			9	25	**34**	
1982			11	32	**43**	
1983	22	13	11	8	**54**	
1984			12	52	**64**	
1985*	29	35	24		**88**	64
1986	20	2	1		**23**	
1987*	13	8	2		**23**	7
1988	14	9	3		**26**	
1989	15	12	3		**30**	
1990	9	13	3		**25**	
1991	12	11	5		**28**	
1992	12	17	6		**35**	
1993	11	19	10		**40**	
1994	15	22	12		**49**	
1995	10	22	15		**37**	14
1996	22	18	13		**53**	
1997	27	26	14		**67**	
1998	19	12	8		**39**	29
1999	25	20	10		**55**	
2000	27	21	11		**59**	
2001	28	27	14		**69**	30
2002	19	19	6		**44**	
2005	22	11	7		**40**	35
2006*	25	12	1		**38**	
2007	25	14	4		**43**	
2008	27	16	7		**50**	
2009	28	18	7		**53**	
2010	31	21	11		**63**	
2011	36	23	14		**73**	
2012	38	30	14		**82**	
2013	52	33	7		**92**	10
2014*	29	13			**42**	36
2015	35	17	11		**63**	
May 2016	36	24	7		**67**	
Dec. 2016	32	26	8	8	**74**	

Sources: Fowler, 1985; USFWS files, Los Banos; BLM Reports to Congress (various); DFG Reports to Legislature (various); CDFW relocation files.

* Total remaining at the end of 1985: 20 bulls and 2 cows;

* In 1987, five implanted cows were added from Detroit Zoo, 7 bulls relocted to Bitterwater;

* In 2006, two cows added from Concord. 2014 survey prior to calving period.

Table 3. Point Reyes National Seashore, Tomales Point, Population and Survey Results.

Year	Number of Elk Counted				Total
	Bulls	Cows	Calves	Unknown	
1978*	2	8	7		**17**
1979	4	8	3		**15**
1980	4	10	1		**15**
1981*	4	8	5		**17**
1982	6	10	8		**24**
1983	10	14	8		**32**
1984			9	32	**41**
1985			10	45	**55**
1986					**70**
1987					**82**
1988					**98**
1989					**112**
1990					**138**
1991					**117**
1992					**185**
1993					**214**
1994					**241**
1995					**280**
1996	95	222	66	2	**385**
1997					**465**
1998*					**450**
1999	174	210	92		**476**
2000	130	260	61		**451**
2001	116	254	50	3	**423**
2002	145	241	30		**416**
2003	91	241	50	4	**386**
2004	81	217	40		**338**
2005	105	246	79		**430**
2006	128	276	114		**518**
2007	156	332	97		**585**
2008	104	270	85		**459**
2009	93	247	45	56	**441**
2010					
2011	140	309	38		**487**
2012	105	291	101	43	**540**
2013	122	189	46		**357**
2014	95	168	23		**286**
2015	86	170	27		**283**

Sources: Fowler, 1985; National Park Service, Point Reyes; BLM Reports to Congress ; CDFW relocation files.

* Initial relocation consisted of 2 bulls and 8 cows from San Luis NWR in March, 1978; initial calves conceived at San Luis NWR. Three adult bulls brought from Owens Valley in December, 1981. 1996 Survey Fixed Wing (DFG plane). In 1998, some 45 elk were captured at Tomales Point and moved to an enclosure near Limantour Beach. Several months later, 28 elk were released from the enclosure.

Table 4. Point Reyes National Seashore, Population and Survey Results, Free Ranging Elk.

Year	Number of Elk Counted				Total
	Bulls	Cows	Calves	Unknown	
1999	3	18	9		**30**
2000	7	16	5		**28**
2001	8	18	6		**32**
2002	8	16	4		**28**
2003	9	19	8		**36**
2004	11	20	9		**40**
2005	12	21	12		**45**
2006	16	28	12		**56**
2007	17	30	11		**58**
2008	32	36	14		**82**
2009	31	46	16		**93**
2010	37	44	23		**104**
2011	37	63	19		**119**
2012	46	87	27		**160**
2013	46	80	21		**147**
2014	67	114	32		**213**
2015	72	108	33		**213**

Source: National Park Service, Point Reyes National Seachore.