



ELK CONSERVATION AND MANAGEMENT PLAN

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FROM OUR DIRECTOR



It is remarkable that in a state with nearly 40 million people, one of the largest, most iconic land mammals in North America is one of our most successful conservation stories. Elk, or Wapiti, meaning “ghost kings” as named by the Shawnee Indians due to the animals’ elusive behavior are coming back from a precipitous population decline. The Department of Fish and Wildlife is proud to present this adaptive, scientifically based management plan that considers the many challenges facing elk in the most populous state in the nation.

We’ve come a long way. In 1870, there were three tule elk left in California. Three. Through the efforts of the Department of Fish and Wildlife, hunters, conservation organizations and Tribes, the three sub-species of elk in California have rebounded to approximately 12,900 animals today. California now supports approximately 5,700 Roosevelt elk, 1,500 Rocky Mountain elk and 5,700 tule elk.

For ages, elk have played a significant role in the lives of our predecessors. Elk are depicted in thousand-year-old petroglyphs and have played spiritual roles in many societies. The goal of this management plan is to maintain, restore and enhance sustainable elk populations into the future. Through this plan, the Department of Fish and Wildlife will advance strategies for recreational use, establish goals for coordination with other governmental agencies, Tribes and the public, and develop methods to alleviate resource conflicts.

Our goal is more than just recovery of a single species. Given future threats such as climate change and ongoing habitat loss – we must learn how to preserve biodiversity on a scale that protects entire ecosystems as well as the species that live within those systems. A lot has changed since more than 500,000 elk freely roamed the state, and we must use the best science available to help guide management actions. A lot is at stake if we don’t act collectively. All Californians benefit when we have healthy and accessible fish and wildlife. We invite you to join us in our quest to advance this vision for elk conservation.

Charlton H. Bonham

Director, California Department of Fish and Wildlife



EXECUTIVE SUMMARY

There are four subspecies of elk in North America. Three occur in California, one of which, the tule elk, is only found here. Prior to non-indigenous settlement, it is estimated the elk population in California was more than 500,000 animals. Elk inhabited most parts of central and northern California extending into Oregon. During this time, indigenous people managed and utilized elk for food, clothing and tools. Non-indigenous settlement decimated California's elk populations. By 1872, only a few tule elk remained in the San Joaquin Valley. With the financial support of hunter tag fees, the Federal Aid in Wildlife Restoration Act (Pittman-Robertson Act – excise tax on sporting arms and ammunition) the Department of Fish and Wildlife (Department), conservation organizations and hunters were able to restore elk to the landscape across California. Through the conservation of suitable, connected habitats and active management including translocation, elk populations have rebounded and are now extending their range into previously occupied areas and beyond. Elk population growth since 1970 has been significant and California now supports approximately 5,700 Roosevelt elk, 1,500 Rocky Mountain elk and 5,700 tule elk.

Elk populations are recovering but will never reach historic levels due to permanent loss of habitat. Maintaining positive trends, in light of an increasing human population, will require minimizing loss of currently occupied habitat to development or conversion to other land uses. Conflicts have arisen with expanding human and elk populations, which have become significant in some areas. Loss or damage to property, public safety, and public health concerns caused the California State Legislature to act. In 2003, Fish and Game Code Section (§) 3952 was adopted and requires the Department to develop a statewide approach for management of elk. Fish and Game Code §1801 is the Department's Conservation of Wildlife Resources Policy, to encourage preservation, conservation and maintenance of wildlife resources under the jurisdiction and influence of the state. This section also provides objectives for the policy that include:



- Providing for the beneficial use and enjoyment of wildlife
 - Perpetuating all species for their intrinsic value
 - Providing aesthetic, educational and non-appropriative uses
 - To maintain diversified recreational uses
 - To provide economic contributions
 - To alleviate economic losses
- 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
 - Description of the necessary contents for individual herd management plans prepared for high priority areas

Fish and Game Code §1802 gives the Department jurisdiction over the conservation, protection and management of fish, wildlife and native plants, and the habitat necessary for biologically sustainable populations of those species. Fish and Game Code §3952 directs the Department to develop a state-wide elk management plan, consistent with the Conservation of Wildlife Resources Policy, and maintain sufficient elk populations in perpetuity, while considering the following:





The Department is committed to developing and maintaining an effective, positive and cooperative relationship with California federally recognized Tribes (Tribes) regarding elk management. The Department and Tribes share authority to regulate the take of elk, with Tribes having authority on tribal lands and the Department over the remainder of the state. 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 (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 conservation, protection, restoration, enhancement and reestablishment

of California's elk populations and habitat. This is critical to providing cultural, scientific, educational, recreational, aesthetic and economic benefits for present and future generations of Californians.

The 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) and establishes broad conservation and management objectives. The 22 EMUs collectively comprise the current known distribution of elk in California with few exceptions. The EMU plans are living documents with objectives focused on priori-

ty actions within a geographic area and are subject to change by the Department as additional information is gathered.

These plans can be updated independent of the main plan and other individual EMUs. 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, Unit Highlights, and Unit Specific Research. The management plan also considers methods of assessing elk population viability. The Department is committed to funding and staffing actions to achieve the goals of the EMUs.

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 and safety problems within an EMU, regulated hunting is the recommended primary method of population control, followed by capture and translocation of surplus animals as resources allow when regulated hunting is infeasible or ineffective.

A draft management plan was made available for public review from November 28, 2017 to January 29, 2018. The Department received over 200 comments on the draft during the comment period. The Department edited the draft based on public input, and then received additional independent scientific peer review from wildlife agencies of four other states (Colorado, Oregon, Utah and Washington) prior to finalizing the draft.

This conservation and management plan provides guidance and direction to help set priorities statewide. The plan establishes general policies, goals and objectives, on a statewide scale. 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 conservation and management will be essential to managing California's elk populations into the future.



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*) as provided in Section 1802 of the Fish and Game Code (FGC §1802). This conservation and management plan (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 Conservation of Wildlife Resources Policy, FGC §1801. The policy emphasizes the following objectives:

- Providing for the beneficial use and enjoyment of wildlife
- Perpetuating all species for their intrinsic value
- Providing aesthetic, educational and, non-appropriative uses
- To maintain diversified recreational uses
- To provide economic contributions
- To alleviate economic losses.

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 2011-2017 the Department received an annual average of 34,394 tag applications for approximately 330 elk tags per year through the Big Game Drawing. Current elk range encompasses approximately 25% (25,171,496 acres) of California (Figure 1). While elk do not occupy the entire geographic area in these range maps, the maps attempt to identify the general distribution of elk.

By 1870, tule elk numbered as few as three animals and Roosevelt elk had also declined (Barnes 1925a

1925b, Harper et al. 1967, McCullough 1969, Meredith et al. 2007). Through the efforts of the Department, conservation partners, and hunters, elk have rebounded to approximately 12,900 animals today and growing (Figure 2). Big game tag fees, Federal Wildlife Restoration funds (known as the Pittman-Robertson Act or "PR" funds), and conservation partners, such as the Rocky Mountain Elk Foundation (RMEF), provide financial and other resources to support these efforts. RMEF has contributed over \$5.3 million for elk and elk habitat recovery in California, including habitat enhancement and restoration, conservation easements, translocations and scientific research.

California's human population (approximately 39 million) is larger than any other state in the nation (U.S. Census Bureau 2012). This poses challenges for wildlife conservation efforts and exacerbates environmental stresses (e.g., land development, urbanization, changes in land management practices, fire suppression, climate change and invasive species) affecting elk populations. Because of increasing conflicts between elk and humans, legislation adopted in 2003 added FGC §3952 and required the Department to prepare a statewide elk management plan consistent with California's Conservation of Wildlife Resources 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 elk subspecies. In part, the need for a statewide plan was supplanted by the development of annual environmental documents and updates related to hunting, which ensured a growing and manageable strategy for elk in California.

Estimated Elk Distribution and Land Ownership, 2017

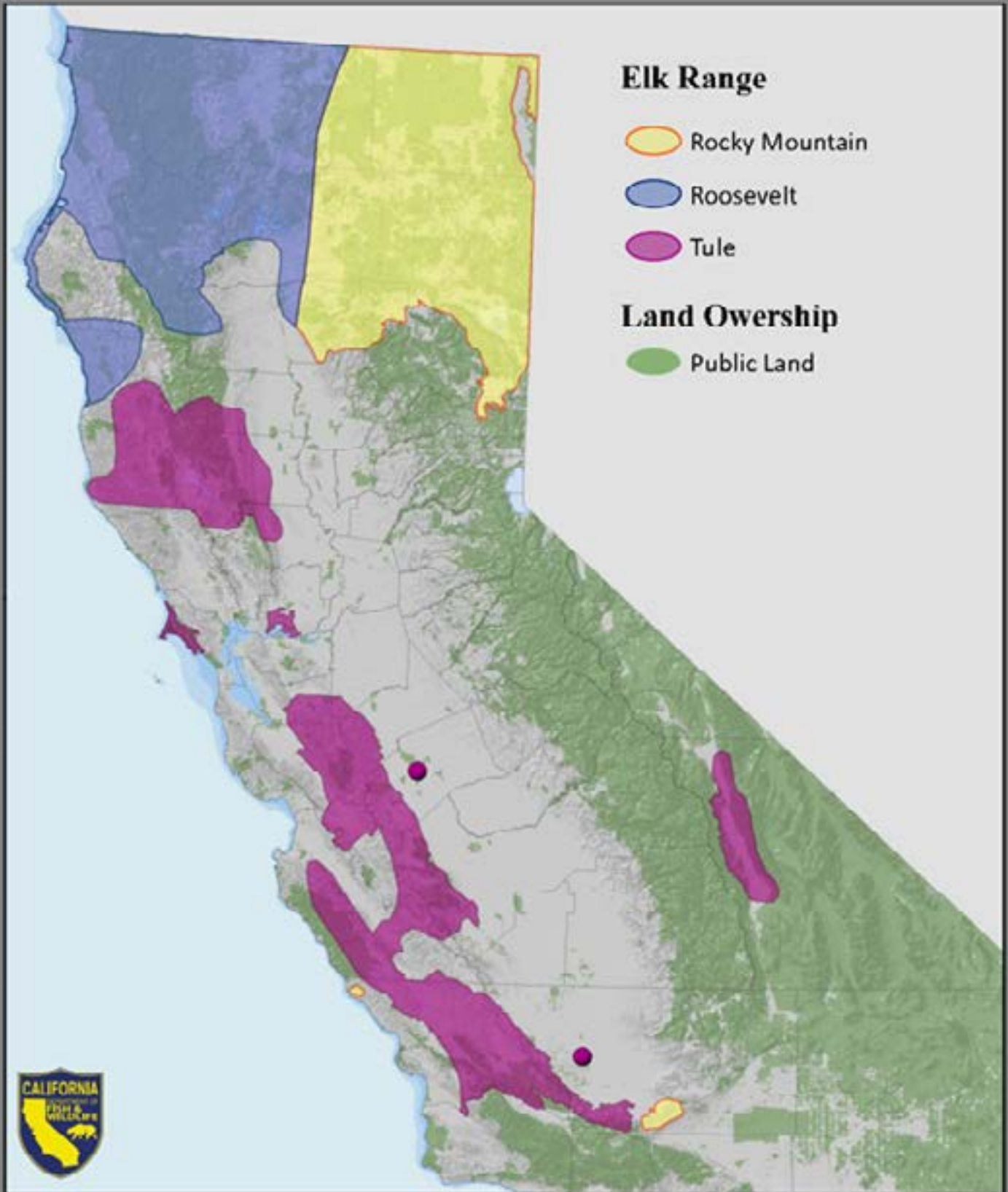


Figure 1. Estimated elk distribution in California and land ownership, 2017.

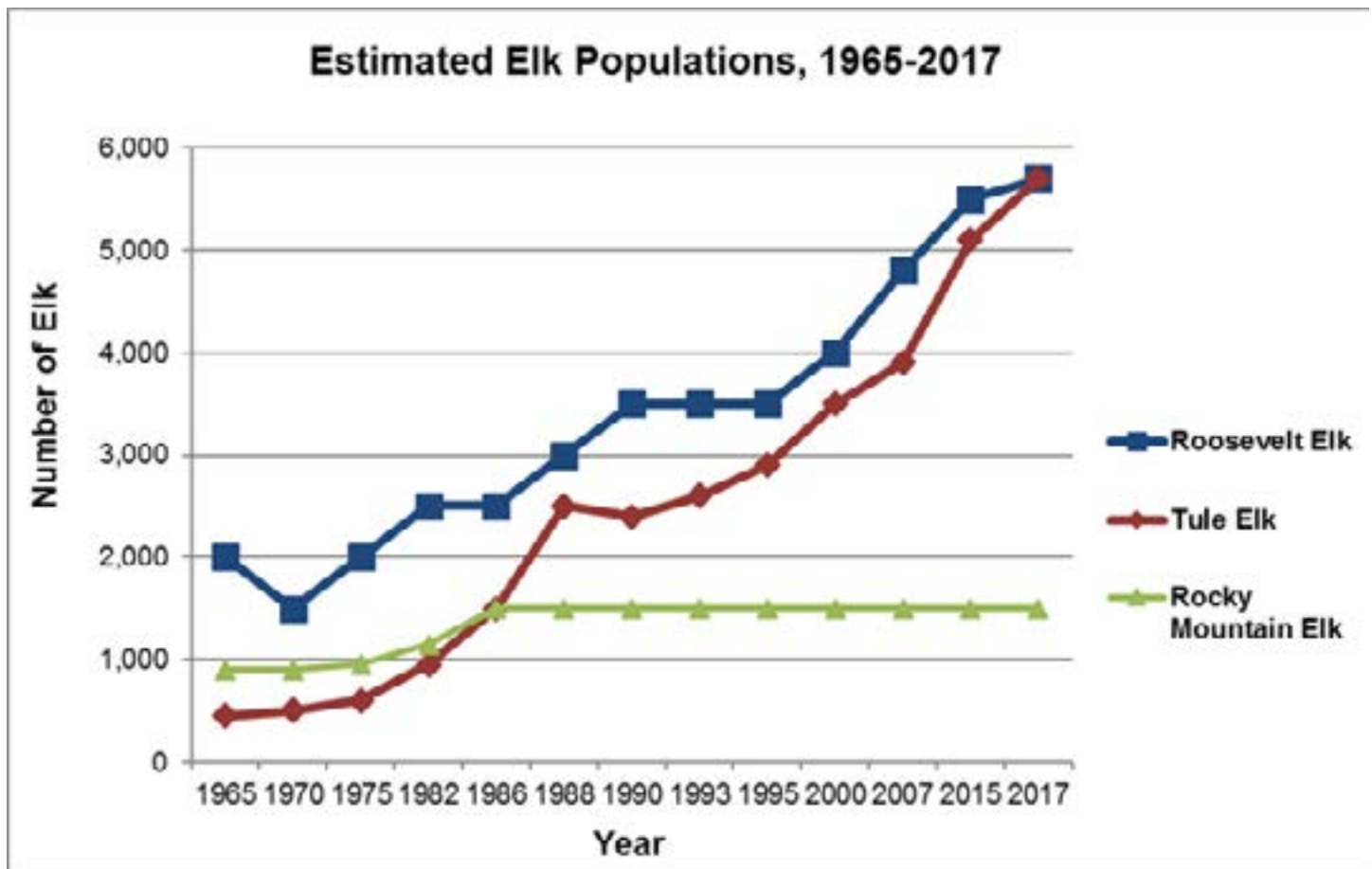


Figure 2. Estimated elk populations in California, 1965-2017.

Based on the Conservation of Wildlife Resources 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. The working group met three times in 2005 and 2006. The recommendations of the working group provided an early foundation for the Department's development of an elk management plan based on

available information and expertise about California's elk and their habitats. Beginning in 2016, the Department began working with California federally recognized Tribes (Tribes) for input to address tribal concerns.

The 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 comprise the current known distribution of elk in California (however, elk are expanding their range and sightings periodically occur outside the EMU boundaries). The EMU plans are living documents subject to change by the Department as

additional information is gathered and updated independent of the main plan and other individual EMUs.

Consistent with other species management plans, EMU plans 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, Unit Highlights and Unit Specific Research. The statewide management plan discusses methods of assessing population viability. The Department is committed to funding and staffing actions to achieve the goals of the EMU plans.

The Department recognizes that some of its proposed activities and species management plans may adversely affect the interests of California 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 jurisdictional boundaries. The Department possesses regulatory authority within state boundaries and Tribes possess regulatory authority within tribal land. A Tribe maintains inherent power to regulate the take of elk by its members within its reservation. (*New Mexico 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 right of self-government. Moreover, the Department is committed to providing 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 California's ecosystems, but have different management strategies.

A. Goals and Objectives

Effective conservation and management of elk requires reliable information on population size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, and their use of habitats throughout the year and over time. This plan establishes a framework for an ongoing monitoring program to evaluate elk populations and habitat conditions. Monitoring population trends and the details of habitat use and distribution will help the Department understand how elk use the landscape and interact with other wildlife species. The goals and objectives identified in this plan and its provisions for information gathering and monitoring will help the Department maintain, restore, and enhance sustainable elk populations into the future. It will allow the Department to modernize strategies for recreational use, establish goals for coordination with governmental agencies, Tribes and the public, and develop methods to alleviate resource conflicts.

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

Table 1. Overall Elk Management Plan Goals and Objectives.

GOALS/OBJECTIVES	COMPLETE BY
GOAL 1: In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.	
Objective 1.1: Continue/complete projects to estimate population abundance, distribution, habitat use, and demographics to provide managers with additional information to make adaptive management decisions.	2023
Objective 1.2: Increase elk populations by at least 10% statewide 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 and areas of hybridization within EMUs, and identify EMUs 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 take as elk move across jurisdictional boundaries.	
Objective 2.1: Develop co-management agreements, memoranda of agreement, or similar mechanisms with Tribes for the management of elk within each appropriate EMU.	2021
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 at least 10% where feasible and compatible with EMU population objectives.	2023
Objective 3.2: The Department will work with other agencies and non-governmental 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 incidents 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



B. Taxonomy and Historical Distribution

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 3). Evolutionary forces and isolation presumably gave rise to Roosevelt elk and tule elk (McCullough 1969).

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 to 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 4 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, where they were 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 became extinct in the eastern and southwestern portions of the continent. The decline of California elk is well-documented (Evermann 1915, Doney et al. 1916, Barnes 1925a 1925b, Ellsworth 1930, Dow 1934, Graf 1955, Harper et al. 1967, McCullough 1969, Tule Elk Interagency Task Force 1979, Fowler 1985, Koch 1987) and summarized in Appendix F. Non-indigenous human settle-

Spread of Elk in Western North America

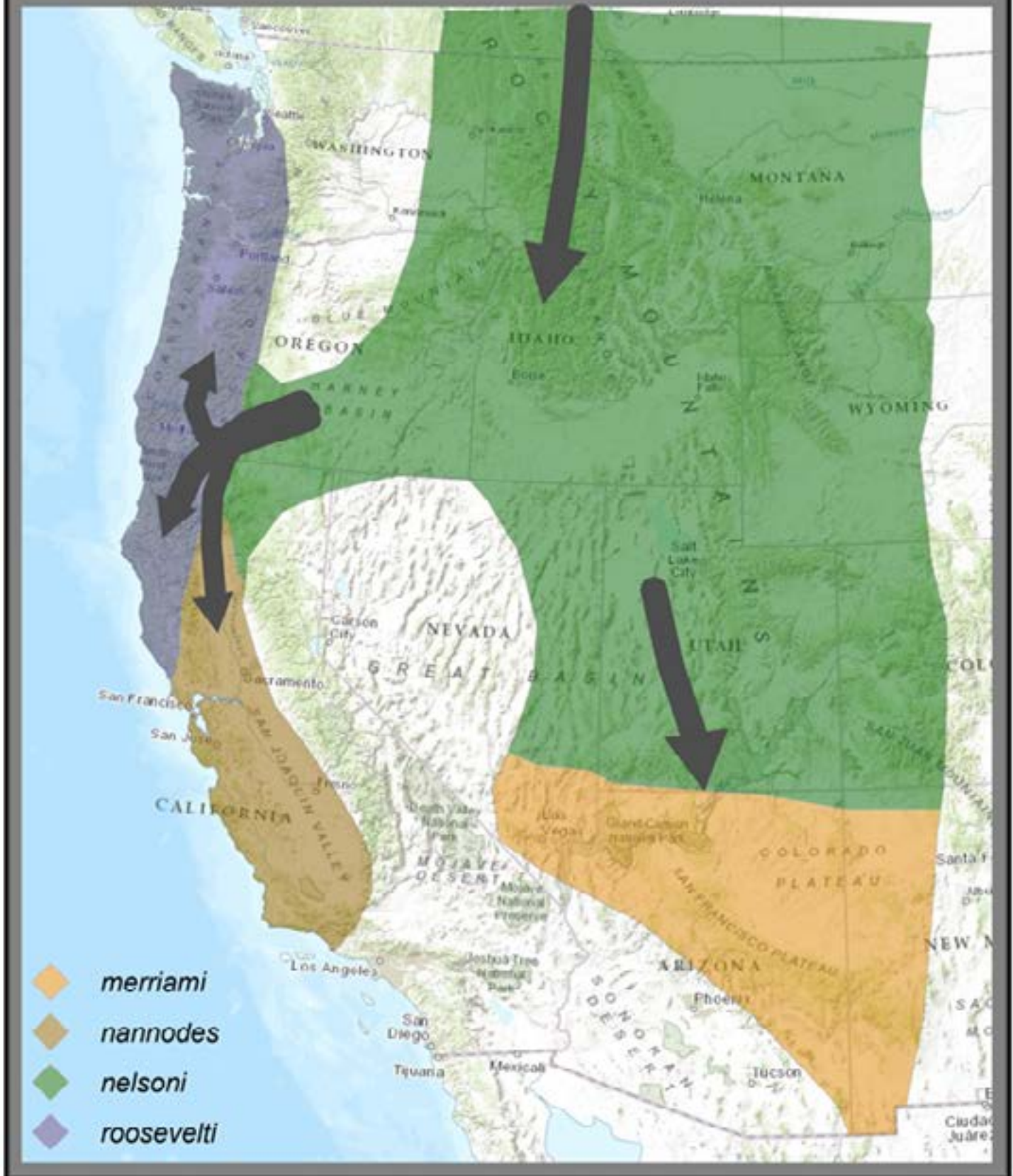


Figure 3. Hypothesized dispersal of elk through western North America (McCullough 1969).

Estimated Historical Elk Distribution

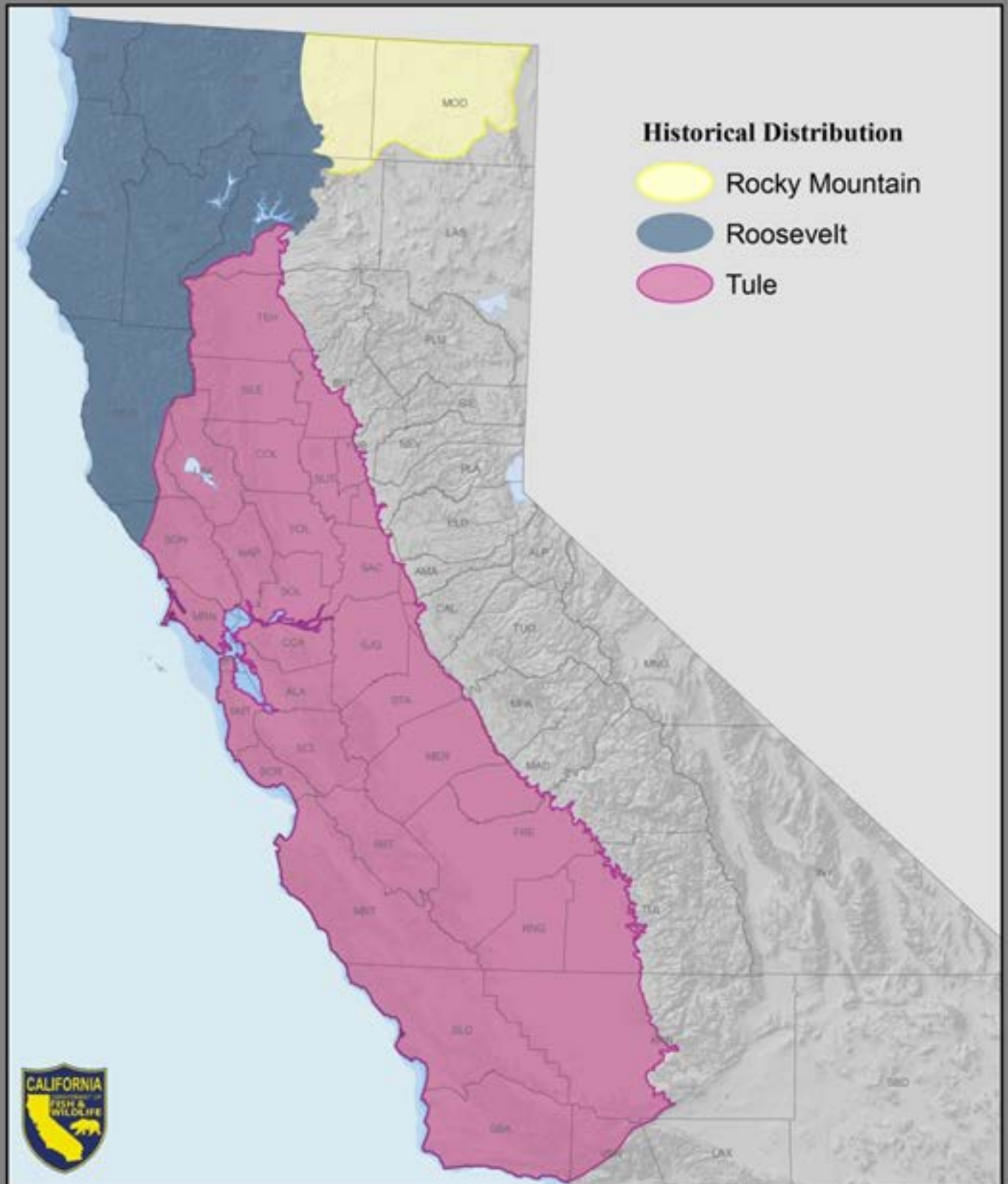


Figure 4. Estimated historical elk distribution in California adapted from Murie 1951, Harper et al. 1967, and McCullough 1969

ment decimated 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). Tule elk were reduced to only a few animals by 1874 (McCullough 1969, McCullough et al. 1996, Meredith et al. 2007).

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 (1951) cited historical accounts of elk in Nevada, 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 confirms 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 1900s. 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 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 Pit 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

Life History - 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, begins as early as August and can extend 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).

Elk are opportunistic feeders and will eat a variety of plant species when 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 (i.e. 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). Elk herds in California have continued to expand through natural dispersal, translocations, and Department management efforts. These expansions occurred with limited 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 (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 at Fort Hunter Liggett in Monterey County 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 devotes considerable resources to investigate 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 or remain stable (California Department of Fish and Wildlife, unpublished data; 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).

Throughout their North American range, elk are susceptible to predation by numerous carnivores including black bear (*Ursus americanus*), coyote (*Canis latrans*), gray wolf (*C. lupus*), grizzly bear (*U. arctos*), and mountain lion (*Puma concolor*) (Barber et al. 2005, Zager et al. 2007, White et al. 2010, Yellowstone National Park (YNP) 2014). Gray wolf and mountain lion are the main predators in California capable of killing a healthy adult elk (Zager et al. 2007, White et al. 2010). In YNP, grizzly and black bear are efficient predators of elk calves while coyote, wolf, and mountain lion 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. No information exists on the specific impact to elk from the gray wolf in California because the gray wolf has only recently re-entered and resided in California. Consequently, predation information from other states is all that is currently available. A 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 for individual herds of elk (Kovacs et al. 2016).

Habitat — The following narrative is a general description of elk habitat conditions in North America, with an emphasis on conditions and trends within California. Elk habitat consists of varying types 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 for escape (California Department of Fish and Wildlife, unpublished data). 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, California Department of Fish and Wildlife, unpublished data).

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, California Department of Fish and Wildlife, unpublished data).

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, fire regimes, logging and livestock grazing significantly altered California's vegetation communities by converting vast acreages to earlier successional vegetation (Gruell 2001). After the mid-1900s, 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 resulted 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).

Timber harvest also altered California's vegetation communities by producing, early seral vegetation in forested habitats to the benefit of elk and deer. However, data from the California State Board of Equalization (CSBOE) in 2014 demonstrate a reduction in timber harvest volume through time on both public and private land (Figure 5). 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 the volume increased to 8.3 times the volume removed from public lands (CSBOE 2014). Timber harvest methods, such as type of harvest (clear cut versus selective) and pre- and post-harvest treatment types (such as herbicide application) also can affect early seral vegetation and habitat quality.

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). Increased fuel load in aging shrublands supports high intensity fires that typically convert remaining shrublands to vegetation communities dominated by non-na-

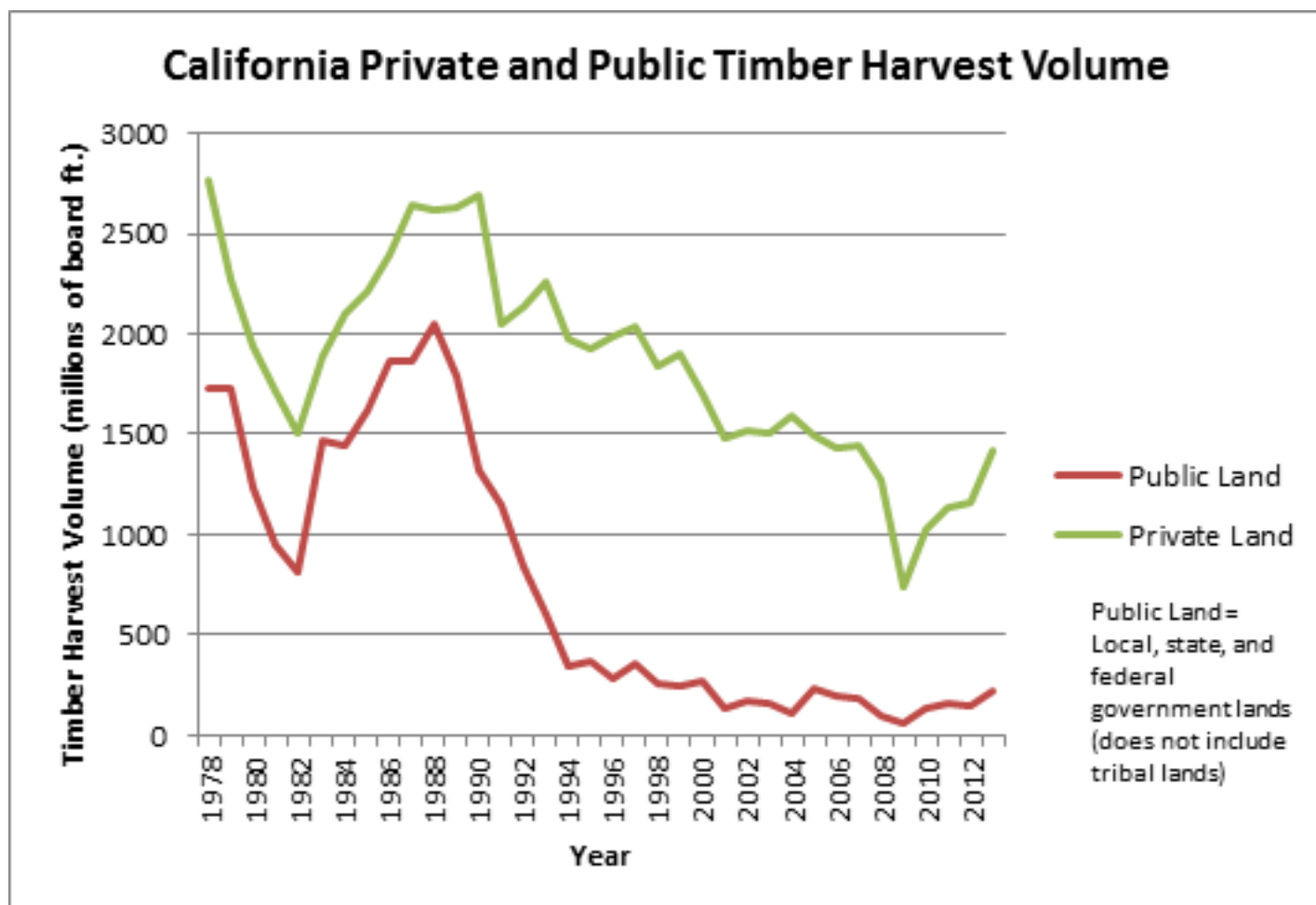


Figure 5. Timber harvested from public and private forests in California from 1978 to 2013 (CSBOE 2014).

tive annual grasses of little nutritional value during certain times of the year, such as cheatgrass (*Bromus tectorum*). Overall, cheatgrass is considered a negative for rangelands but does have nutritional value during the winter and spring period for deer and elk (Bishop et al. 2001). 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).

Thus, fire suppression, timber harvest and livestock grazing have altered habitat in California. To the extent they have produced early seral vegetation in forested habitats, these activities have been beneficial to deer and elk. Deer population levels in California have declined over time (i.e. the last 50 years), whereas elk populations have gradually increased. Since carrying capacity is difficult to determine over large areas of diverse habitat types, the maximum elk population size within the various provinces of California is unknown. It is likely that additional early successional habitat would result in higher elk populations.

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 and private timber lands through review of timber harvest plans. The Department directly manages only a small fraction of land

within current elk range. The Department owns six 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 Carrizo Plains Ecological Reserve in San Luis Obispo County, and undesignated mitigation land (the future North Carrizo Ecological Reserve) in San Luis Obispo County. Management activities include controlling invasive weeds, installing water sources, conducting research, and planting food plots.

D. Distribution and Population Status Since 1970

Efforts during the early 1900s to translocate elk in California were sporadic and generally met with limited success (McCullough 1969, Dasmann 1975). By 1970, elk in California occupied less than 10% of their historic range (Figure 6); their distribution and abundance had 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 moved to reestablish and augment herds at more than 20 locations in California. The Management Plan for the Conservation of Tule Elk (Tule Elk Interagency Task Force 1979) pro-

Estimated Elk Distribution 1970

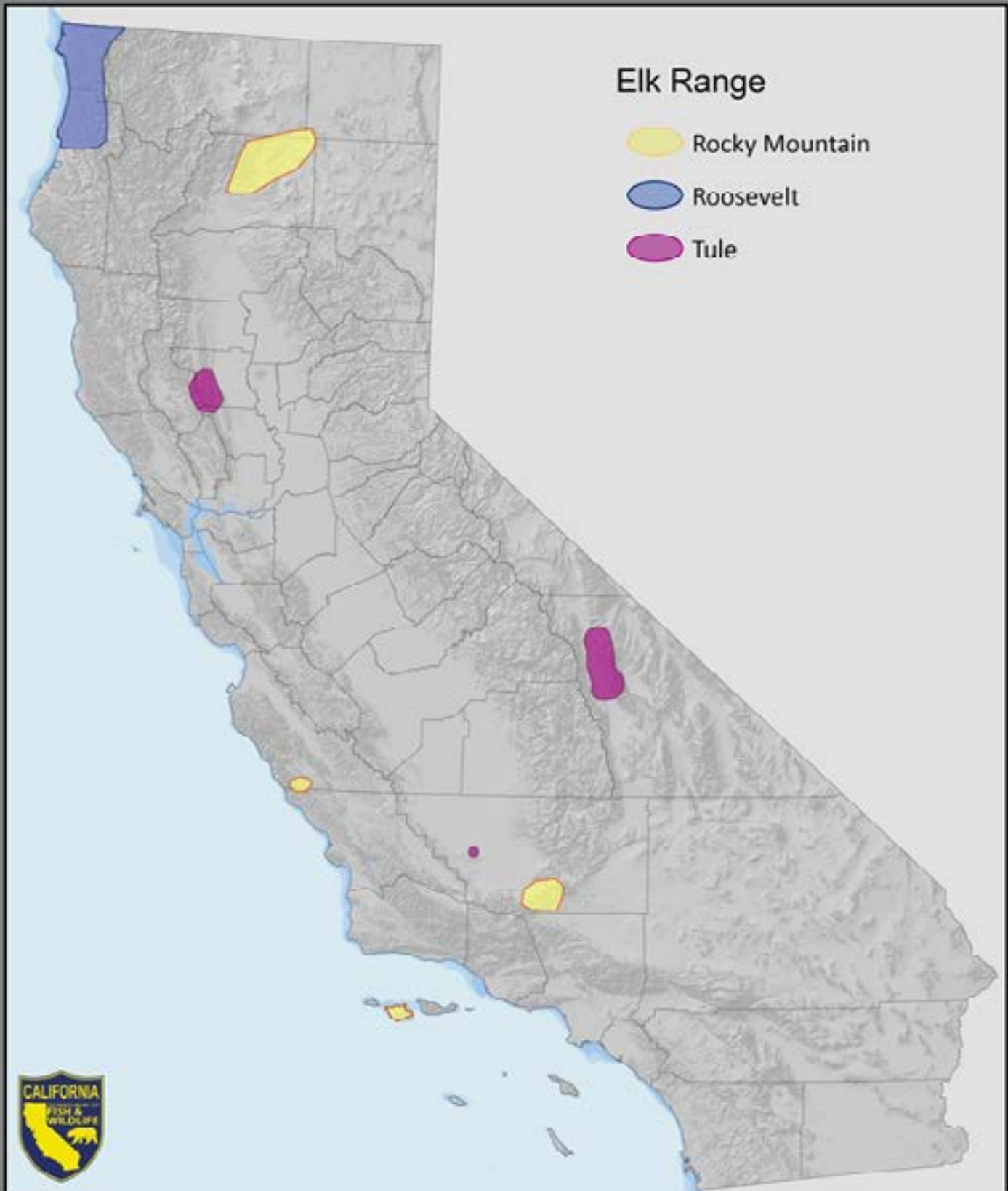


Figure 6. Estimated distribution of elk in California, 1970.

vided specific criteria for an area to be considered a suitable tule elk release site. These criteria (Appendix G) employ sound biological principles, and consider land use practices and the laws and regulations of the state. 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 to 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 to 1984, the Department translocated 24 Roosevelt elk from Redwood National Park (RNP) to the BLM King Range National Conservation Area (McCoy 1986). Elk are now 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.

As Roosevelt elk herds grew in areas of northern California and Oregon and established at the translocation sites discussed above, they naturally dispersed to unoccupied habitat in several new northern California locations. For example, sightings of Roosevelt elk near Grass Lake in eastern Siskiyou County were



reported as early as 1965 (California Department of Fish and Game, unpublished data). Elk are now well established in the Grass Lake area, which is within the Siskiyou EMU.

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 EMU 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). 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). 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-non-indigenous human) 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 5,700 individuals (California Department of Fish and Wildlife, unpublished data). There are four

Elk Management Units (EMU)



Figure 7. Elk Management Units.



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 an unchanged population in Rocky Mountain elk (particularly since 1986); however, the Department lacks sufficient information regarding Rocky Mountain elk population size to make trend inferences.

Elk Management Units

Consistent with the requirements of FGC §3952 the Department has identified 22 geographic areas for elk management, referred to as Elk Management Units, as high priority areas (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 bound-

aries are based on current and potential distribution, future elk distribution may expand beyond established boundaries and additional EMUs may be established or existing boundaries updated as elk distribution changes.

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.

Table 2. Elk Management Unit Goals and Objectives. This table is subject to future revisions consistent with updates and/or changes made to the Elk Management Unit Plans

MANAGEMENT GOAL	MANAGEMENT OBJECTIVES*
In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.	Continue/complete projects to estimate population abundance, distribution, habitat use, and demographics to provide managers with additional information to make adaptive management decisions
	Increase/maintain elk populations in areas where human-elk conflicts are expected to be minimal
	Enhance or increase elk habitats by at least 5%
	Implement a cause-specific mortality study and determine if identified factors are limiting population growth (e.g., predation/disease)
	Collaborate with Caltrans to provide information and recommendations to reduce vehicle collisions
	Identify the genetic diversity of the population and determine if individuals are hybridizing with other subspecies
	Determine the prevalence and significance of exotic lice on tule elk
	Determine habitat relationship between elk, livestock, and feral horses
	Maintain population within EMU objective and composition
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 jurisdictional boundaries	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 EMU
	Work with Tribes to complete monitoring and/or habitat projects that will assist in guiding management decisions or enhancing elk habitat
Enhance opportunities for the public to use and enjoy elk (e.g. hunting and wildlife viewing).	Increase/maintain/develop elk hunting opportunities where feasible and compatible with population objectives
	Work with other agencies and NGOs to install elk interpretive signs
	Conduct elk workshop to inform the public about elk and elk viewing opportunities
	Increase elk viewing and educational opportunities
	Provide information on the Department web page to inform the public about elk and elk viewing opportunities
Alleviate human-elk conflicts and elk depredation complaints	Reduce incidents of human-elk conflicts on private property by at least 25%
	Continue to monitor human-elk conflicts on private property
Reduce the number of confined herds and the frequency for removing excess animals	Eliminate one or more confined herds
	Reduce population levels within enclosures and identify preferred population control methods.
Enhance habitat within enclosures	Enhance elk habitats by at least 5%

*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 objectives listed here to account for differences within EMUs. NA - Not Applicable, OG - Ongoing

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
2023	2023	2023	2023	2023	2023	2024	2024	2024	OG	2023	2023	2024	2023	2023	2024	2023	2025	2023	2023	2023	2024	NA
2028	2028	2028	2028	2028	2028	2028	2028	2028	NA	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	OG	NA
2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	2028	NA
2023	2023	2023	2023	2025	2025	2025	2025	2025	NA	2023	2023	2024	2023	NA	2024	2024	NA	NA	NA	2025	NA	NA
2023	NA	2023	2023	2023	2023	NA	2023	NA	NA	NA	NA	NA	NA	NA	NA	2023	NA	NA	2023	NA	NA	NA
2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	NA
NA	NA	NA	NA	NA	NA	2025	NA	NA	NA	NA	NA	NA	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	2028	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	OG	NA
2021	2021	2021	2021	2021	2021	NA	2021	NA	NA	NA	NA	NA	NA	2021	NA	2021	NA	NA	2021	NA	NA	NA
2023	2023	2023	2023	2023	2023	NA	2023	NA	NA	NA	NA	NA	NA	NA	NA	2023	NA	NA	2023	NA	NA	NA
2023	2023	2023	2023	2023	2023	2023	2023	2023	2021	OG	OG	2023	2023	2025	2023	2023	OG	2020	OG	2022	2023	NA
2023	NA	NA	NA	NA	NA	2024	2024	2023	2024	2024	2024	NA	2023	NA	NA	2023	NA	NA	2023	NA	NA	NA
2023	NA	2023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2023	NA	NA	2023	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2023
2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020
2023	2023	2023	2023	NA	2023	NA	2023	2023	NA	NA	NA	2023	2023	2023	2023	2023	2025	2025	2023	NA	NA	NA
NA	NA	NA	NA	OG	NA	NA	NA	NA	NA	OG	OG	NA	NA	NA	NA	NA	NA	NA	NA	OG	OG	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2025
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2025
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2028

An EMU plan was not prepared for the Point Reyes National Seashore (PRNS) free-range herds. The Department is working cooperatively with PRNS staff as they develop a General Management Plan Amendment Environmental Impact Statement, which includes management of free ranging elk in the ranched areas on National Park Service lands. Once complete, an EMU plan will be developed for the PRNS free ranging elk herds. Updates to individual EMU plans will occur as additional data are collected and to reflect co-management agreements, memoranda of agreement, or similar mechanisms with Tribes affiliated with the EMU, private landowners, and land management agencies. 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 PRNS at Tomales Point (Marin County).

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

Historical translocation efforts contributed to the recovery of elk populations in California. Other historical elk management activities included periodic regulated hunting prior to 1986, and consistent annual hunting beginning in 1986. Additional management efforts involved monitoring pathogens/parasites, distribution/movement, habitat use, food studies, population size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 most likely at densities less than those prior to non-indigenous 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.

Direct protection of elk and highly regulated hunting have allowed elk populations to expand, leading to unwanted encounters with humans. 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), and Rocky Mountain elk (California Department of Fish and Game 1959, California Department of Fish and Wildlife, unpublished data). Previous management efforts involved developing methods to alleviate or otherwise 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 cul-

tures, 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 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. 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 protected species such as spotted owl (*Strix occidentalis*), California condor (*Gymnogyps californianus*), porcupine (*Erethizon dorsatum*), tan-oak (*Notholithocarpus densiflorus*) and salmon (*Oncorhynchus* species).

Activities such as reducing conifer encroachment in ridgeline meadows for summer habitat, increasing 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 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 activities 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 PR funds. Prior to establishment of the BGMA, the elk program relied heavily on revenue from annual elk fund-raising hunt tags (which varied from year to year) and PR funds.

II. CONSERVATION AND MANAGEMENT

Elk conservation and management in California is a complex undertaking. In order to be successful, the Department must not only adhere to sound scientific principles, it must also work with diverse interested parties. The plan ultimately must include actions and approaches that include, but may not be limited to the following: 1) the ability to apply adaptive management; 2) implement monitoring for populations, herd viability, and genetic diversity; 3) conduct disease surveillance; 4) coordinate with Tribes; 5) implement an effective hunting program; 6) carry out depredation and alleviation responses; and, 7) explore how human dimensions interacts with elk management and conservation. The statewide plan sets the overarching goals and objectives for management while the EMU plans include more specific local or regional priorities and actions for elk management. The EMU plans will be updated as needed based on ongoing monitoring and implementation of actions that will improve the understanding of elk population dynamics and inform management decisions into the future.

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 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 management plan, such information, in addition to data from inventory, research and monitoring will inform implementation of actions toward achieving the goals and objectives. As the Department collects and analyzes elk data it will adjust management decisions as appropriate.

Pursuant to FGC §703.3, resource management decisions by the Department should incorporate adaptive management to the extent possible. The Department's intent is to improve the conservation and management of elk by incorporating adaptive management principles and processes into elk conservation and management, utilizing the processes identified in the California State Wildlife Action Plan (California Department of Fish and Wildlife 2015).

This includes:

- Designing population monitoring and investigations essential to an adaptive management framework
- Improving the Department's understanding by producing new information obtained through monitoring, investigation, and credible scientific sources
- Regularly re-evaluating, based on the best available science, and adjusting, if needed, conservation and management strategies and practices to meet long-term goals

Table 1 identifies goals and objectives for elk conservation and management. The Department will collect, analyze and share data pertaining to those objectives. This will allow the Department and stakeholders to evaluate success in meeting objectives and determine necessary adjustments in data collection, monitoring and actions to achieve objectives.

B. Population Monitoring

Population monitoring is an essential tool for effective management and conservation of elk in California. Accurate population estimates are important because of the irregular distribution of this species and its subspecies throughout the state, and its expansion in some areas. In addition, hunting demand, the potential for human-elk conflict, and interactions between elk and other wildlife vary throughout the state. With improvements in technology and advances in understanding of population dynamics, the Department continues to advance its survey techniques and improve them over time.

Over the past several decades, the Department has used a variety of aerial- and ground-based survey methods to monitor elk populations within EMUs throughout the state (Table 3). These methods generated abundance indices that may not adequately address sources of bias including detection probability and assumptions about sampling areas (such as habitat uniformity and elk distribution). To improve data quality, the Department is transitioning to more robust survey and analytical methods that provide more accurate and precise estimates of density and population size. This approach will set a baseline against which to measure population trends. It will also enable better understanding of environmental factors affecting elk conservation and management.

Recent advances in field survey methods, genetic analyses, and statistical modeling provide opportunities for the Department to improve elk monitoring in California. The Department has begun to investigate and implement these methods. The Department's aerial surveys can be better targeted to areas

of the state where they are most effective, such as flat, open areas with good visibility. In these circumstances, traditional methods, including distance sampling and sightability modeling, accurately estimate population size and account for variations in detection probability due to terrain, weather, and differences among human observers (Bleich et al. 2001, Buckland et al. 2001, McCorquodale et al. 2012). Adaptive cluster sampling (Thompson 1990) instead of simple random or systematic sampling could be added to the design to help limit helicopter flight time to reduce expense and risk to participants. In practice, an adaptive sampling design could entail the use of fixed wing flights and telemetry to pre-identify elk sampling clusters before helicopter surveys begin.

Aerial surveys in much of northern California, including Humboldt, Del Norte, Trinity, and parts of Siskiyou counties, are challenging to implement because dense forest canopies, steep hillsides, and low densities of elk make accurate enumeration difficult (Samuel et al. 1987, Anderson et al. 1998, Jarding 2010). However, McCorquodale et al. (2012) demonstrated that mark-resight analysis of aerial surveys yielded reasonably precise population estimates in forested areas of Washington state where the performance of sightability models was unsatisfactory. The mark-resight aerial survey approach could be readily applied in forested areas of California, but it is expected to be expensive because a large number of "marked" elk would likely need to be fitted with global positioning system (GPS) collars.

Recent advances in genetic sampling and ground-based camera surveys may provide a more economical yet robust alternative to aerial surveys in forests

and other parts of the state where visibility from the air is low. Fresh fecal samples collected along transects or from within quadrats can be sequenced in a genetics laboratory to identify individual elk and their sex. These data can be used in a spatial capture recapture model to directly estimate population size and the environmental factors that explain variation in density across a large region of management interest (Royle et al. 2014, Brazeal et al. 2017). Over the past five years, the Department has made rapid progress expanding the use of this method for monitoring mule deer throughout the state (Lounsberry et al. 2015, Brazeal et al. 2017). Additional data from camera stations and GPS telemetry can be integrated with the genetic surveys to further refine estimates of population size by sex and age class (Furnas et al. in review). The survey design used for deer is unlikely to be directly applicable to elk, however, because the spatial ecology of elk is very different from that of deer (e.g., elk are less common but more clustered where they occur). For this reason the Department is currently collaborating with researchers at UC Davis to develop a sampling design for combined use of fecal DNA and camera stations that works best for elk in California. In brief, the methods stratify sampling across a large region based on initial species distribution modeling of existing occurrence data, and the intensity of spatial sampling at survey locations is increased in lieu of repeated visits. Initial results from the Central Valley and Coast Range are promising (Brazeal and Sacks 2017, Batter et al. 2018). Over the next several years, the Department expects to expand use of fecal DNA surveys, camera stations, and integrated modeling of resultant data throughout forests and other areas of the state. Each EMU plan lists techniques used for population assessment and monitoring (Appendix E), and identifies units in need of improved or additional monitoring.

The small size of some EMUs (e.g., Grizzly Island and Lake Pillsbury) or some confined herds such as Point Reyes may warrant evaluation of alternative methods. For example, ground count censuses have been used for many years at Point Reyes National Seashore (Howell et al. 2002, Cobb 2010). The locations of elk groups are first identified and then repeated visual counts are made of each group over a number of days. The sum of maximum daily counts from each group can be used to estimate population size. Fecal DNA is also being used to robustly estimate population size for small areas (e.g. San Luis National Wildlife Refuge, Brazeal and Sacks 2017). Lastly, small unmanned aerial vehicles (UAV), or drones, are increasingly being used in wildlife research, including to survey for ungulates (Chretien et al. 2016). An UAV fitted with a visual and/or infrared camera could be used to efficiently locate elk groups and enumerate the size of each group. Table 3 also identifies new survey methods that could be utilized. Over the next several years, the Department will research and refine use of these methods for estimating population size of small EMUs. Appendix I summarizes the different survey methods and under what circumstances they could be utilized.

Table 3. Existing and proposed survey methods conducted within Elk Management Units. Existing methods include helicopter (H), fixed wing aircraft (F), ground surveys (G), camera stations (C), and opportunistic sightings (O). New survey and analytical methods include sightability modeling for aerial surveys (Aerial S), mark-resight for aerial surveys (Aerial M), spatial capture recapture and integrated modeling for combined fecal DNA and camera station surveys (Fecal), and specialized designs for smaller areas using a mixture of ground counts, fecal DNA and drone photography methods (Small Area).

Table 3. Existing and proposed survey methods conducted within Elk Management Units.

	EXISTING SURVEY METHODS					PROPOSED NEW SURVEY METHODS			
EMU	H	F	G	C	O	Aerial _s	Aerial _M	Fecal	Small Area
Alameda/San Joaquin	X	X			X		X		
Cache Creek	X		X			X	X	X	
Camp Roberts	X		X				X		
Central Coast	X		X			X	X		
East Park/Bear Valley	X					X	X		
Fort Hunter Liggett			X				X	X	
Grizzly Island			X						X
La Panza	X	X					X		
Lake Pillsbury			X			X			X
Marble Mountains			X	X		X		X	
Mendocino Roosevelt			X			X			
Mendocino Tule			X			X	X		
North Coast			X	X	X	X		X	
Northeastern	X			X		X			
Owens Valley	X	X	X				X		
Point Reyes-Free Range			X						X
Salinas/Fremont Peak	X					X	X		
San Emigdio Mountain			X				X		
San Luis Reservoir	X	X					X		
Santa Clara/Mount Hamilton	X		X			X	X		
Siskiyou					X	X	X		
Confined Herds			X						X

C. Population Viability and Genetic Diversity

Population Viability — Consistent with state policy to conserve wildlife resources (FGC §1801), and FGC §3952, that direct the Department to consider “methods for determining population viability and the minimum population level needed to sustain local herds”, the Department has identified a goal of increasing elk populations by at least 10% where human-elk conflicts are expected to be minimal. The FGC does not define population viability or otherwise quantify the minimum level needed to sustain a herd. Federal regulations 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 literature related to viability of wildlife populations, particularly elk. The Department also reviewed elk management plans and related documents prepared by other states, and federal agencies responsible for managing well-established herds (i.e. the Rocky Mountain region of the United States), as examples of population viability analysis. The National Forest Management Act directed the USFS to preserve viable wildlife populations on land under its jurisdiction. Appendix H discusses elk population status and minimum viable population (MVP) levels for selected forests in the western United States. Based on selected criteria a rough calculation of MVP for each EMU in California is also presented in Appendix H.

Based on Department review of population viability, there is no single best method for determining how large a population should be to ensure persistence. This is likely due to varying assumptions, including inconsistent or conflicting methodologies and vari-

ations in observed environmental parameters (e.g., habitat conditions, population size, density, age structure, fecundity [birth rates], mortality [death rates], sex ratio, dispersal, predation, parasites, pathogens, density dependence, genetics, stochastic events, and a host of other factors).

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 and fragmentation of the state’s rural landscape. In regards to MVP size, the Department intends to maintain at least 5,000 tule elk statewide with at least 100 individuals in each unconfined EMU, or the higher calculated MVP identified in Appendix H. The Department can modify these MVP thresholds with advances in population viability analysis and techniques to determine MVP size. Statewide tule elk numbers have increased significantly since 1970 (Figure 2), and it is reasonable to expect continued increase into the future as they expand their range. Maintaining long-term viability of California’s elk herds requires sustaining 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). A discussion of individual herd viability appears within corresponding EMU plans.

Genetic Diversity — Changes in the number 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 (Williams et al. 2004, Meredith et al. 2007). 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).

Maintaining genetic diversity and maximizing genetic interchange between isolated yet healthy (i.e. disease free) elk populations is a management plan objective (Objective 1.4). Previously described information on tule elk population genetics informed past translocation decisions (Williams et al. 2004, Meredith et al. 2007). Periodically and opportunistically, the Department translocates small groups of elk within a subspecies to enhance the genetic diversity of geographically isolated populations. This has been accomplished when overpopulated elk from fenced enclosures were moved to augment existing populations and promote genetic diversity. However isolated populations of Roosevelt elk (in southern Humboldt and northern Mendocino counties) and Rocky Mountain elk (in Kern County), might benefit from similar augmentation in the

future. Additionally, the Department will identify and seek to protect potential movement corridors between established EMUs. The Department is currently collaborating 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).

California has three distinct subspecies of elk. Within these subspecies there are further distinctions based on observed differences in microsatellite DNA allele frequencies. According to Meredith et al (2007), Roosevelt elk within Del Norte and Humboldt counties and tule elk should both be considered evolutionary significant units (ESUs) due to the extent of their genetic divergence from other sampled elk populations. An ESU in this plan is defined



as a lineage demonstrating highly restrictive gene flow from other such lineages within the higher organizational level of the species (Fraser and Bernatchez, 2001).

The designation of Roosevelt elk in Del Norte and Humboldt counties as an ESU recognizes that the individuals there have less genetic evidence of hybridization with Rocky Mountain elk than Roosevelt elk in other northern California counties. Hybridization between Roosevelt and Rocky Mountain elk was confirmed within Modoc, Shasta and Siskiyou counties (Meredith, et al. 2007). However, Roosevelt elk in Siskiyou County west of Interstate 5 showed the same genetic characteristics as those in Del Norte and Humboldt counties. Thus, Interstate 5 may be a physical barrier which prevents the long distance movement for which elk are known (Meredith, et al. 2007).

Tule elk statewide are also advised to be considered an ESU by Meredith, et al. due to their genetic differentiation from other elk subspecies. Conservation efforts for this ESU should concentrate on maintaining connectivity between remaining populations and translocations of tule elk between herds should continue. Although tule elk do not currently exhibit the effects of inbreeding depression, such as low reproductive rates, or morphological deformities, the individual herds are at risk if they remain genetically isolated (Meredith et al. 2007). Periodic genetic monitoring is warranted to detect loss of genetic diversity.

D. Disease Surveillance

The Department's Wildlife Investigations Laboratory (WIL) in collaboration with Elk Program and regional staff coordinates health and disease investigation and monitoring in California's elk populations. Diseases of particular concern are those that could impact elk populations or management such as chronic wasting

disease (CWD), foreign animals diseases that affect livestock such as tuberculosis, brucellosis and Johne's disease; or other infectious and non-infectious emerging diseases. As part of the management plan, the Department will continue to test elk that exhibit signs of disease and conduct investigations of unusual die-offs or events involving sick elk. Additionally, the Department will continue to perform serologic surveillance of important livestock diseases from elk captured as part of management activities throughout the state. These efforts will help determine the need for and direct any potential active surveillance efforts. Active surveillance for CWD will occur as part of a statewide CWD management plan in development. Fragmented populations, populations on marginal habitat, dense populations, or populations that overlap significantly with livestock may be at increased risk for disease outbreaks and could potentially serve as sentinel populations for initiating enhanced surveillance plans.

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). In a few instances, disease played a large role in elk mortality. At least one outbreak occurred 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, D. Press, Point Reyes National Seashore, personal communication). 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). Cattle ranching and dairy farming occur within a portion of the PRNS. Johne's disease was documented on five of 10 PRNS dairies and in both non-native axis and fallow deer on PRNS (Riemann et al. 1979). 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). Elk game farms have been identified as a potential disease source in other states. This risk is greatly reduced in California because farming of elk is prohibited (FGC §2118.2) and no elk game farms exist in California. Currently three fenced tule elk enclosures (Appendix E) are managed by the California Department of Parks and Recreation (CDPR), USFWS and NPS.

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.

CWD is a contagious and fatal disease that affects nervous systems of elk, white-tailed deer (*O. virginianus*), mule deer and moose (*Alces alces*). 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, 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 and *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 routine testing of 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. This testing is 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 and 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 the Department is committed to communicating and consulting with Tribes on a government to government basis regarding elk management issues. Numerous Tribes have stated the need to co-manage elk across jurisdictional boundaries 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 and the stomach casing was utilized as a bag in which to boil liquids. The large antler served to make fine purses, 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 toward expanding access to cultural foods and reestablishing traditional food management and distribution. Elk are a critical component of local food systems 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 (*Tricholoma matsutake*), huckleberry (*Gaylussacia* species, *Vaccinium* species) 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 is a primary tool available to help manage elk populations. Recreational hunting opportunities for elk produce revenue that directly supports the management of not only elk, but conservation of diverse habitats across the landscape that benefit multiple species. Hunting tags are currently available through the Department's public Big Game Drawing, the Private Lands Management (PLM) program, Cooperative Elk Hunting (T14, CCR, \$555), the Shared Habitat Alliance for Recreational Enhancement (SHARE) Program, 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 most hunters.

To encourage protection and enhancement of elk habitat and provide eligible landowners opportunity for limited elk hunting on their lands, the Department may establish Cooperative Elk Hunting



areas and issue license tags to allow the take of elk. Landowners of not less than 640 acres of critical elk habitat within an elk tag quota zone are eligible for a limited number of tags. The number of cooperative elk hunting license tags shall not exceed 20 percent of the number of public license tags for the corresponding public hunt and shall be of the same designation (i.e., antlerless, spike bull, bull, or either-sex) as the public license tags.

The Department's 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, upland game, waterfowl and elk. The SHARE program could expand to provide additional opportunities to hunters, as well as economic incentives to landowner participants.

Elk hunt tags are in high demand in California, with over 36,000 applicants for the 320 general draw elk tags (bull, antlerless and either-sex) issued in 2017. 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 2017, 247 PLM elk tags were issued and 63 antlerless and 102 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 hunters in California. The Depart-

ment understands that conditions vary from EMU to EMU and recognizes development of new strategies or approaches might be necessary to address local conditions. For example, to keep the general hunting public engaged, the Department recommends that the number of PLM tags issued should not exceed 50 percent 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 Title 14, CCR.

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 response 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 possible. The Department initially gathers information about the type of damage, characteristics of the property, and any previous history of depredation issues. The Department then works with the landowner to identify and implement appropriate techniques to alleviate or prevent future 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 appropriate) to alleviate conflicts. Through the Cooperative Elk Hunting and SHARE programs, 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 recurring depredation conflicts.

For example, where hunting programs are infeasible, 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.

Individual EMUs with population levels below the maximum population objective that experience human-elk conflicts in a portion of the EMU may warrant targeted management actions. 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 possibility of implementing surplus game hunts (as specified in FGC §325) is an alternative if other methods prove unsuccessful. Surplus game

hunts can occur after an investigation and the Fish and Game Commission (Commission) finds the elk population has increased in any areas or districts to such an extent that a surplus exists, or that damage to public or private property, or overgrazing of their range occurs.

H. Human Dimensions

Traditionally, wildlife conservation and management focused on balancing the needs of wildlife and habitats; however, contemporary approaches include the incorporation of 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 Department will make efforts to incorporate these human dimensions as a means of receiving feedback during its public information and interpretive programs involving elk as identified in objectives 3.2 and 3.3 in Table 1.

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, psychological or social benefits provided by consumptive or non-consumptive use of wildlife) (Decker et al. 2012).

III. UNRESOLVED MANAGEMENT ISSUES AND INFORMATION NEEDS

A. Key Uncertainties

The Department has identified key uncertainties which currently, or could in the future, influence the health and stability of elk populations in California, thereby requiring conservation actions to be implemented to diminish their effects. Additional monitoring is warranted as changes that are undetected or detected too late could have negative impacts to the elk resource. A discussion of each of these uncertainties follows.

HABITAT LOSS/CHANGE

Habitat loss, through permanent or temporary conversion to other purposes, is an important stress that occurs throughout California. It is often the result of land development, infrastructure projects and agricultural activities. Habitat loss can result in the elimination of individuals or populations from converted areas. Habitat loss resulting from development is typically permanent. However, habitat loss caused by agricultural use, pollution and invasive species may replace existing habitats with a different seral stage or habitat types that retain value as forage or cover. Such changes may be reversible in some cases (California Department of Fish and Wildlife 2015).

Habitat fragmentation is a secondary effect of habitat loss that divides natural areas into smaller, isolated remnants through the loss of plant communities or changes in ecosystem processes. This can occur through degradation or removal of a portion of originally connected habitats or construction of linear features that divide habitats. Significant habitat fragmentation in historic times was almost entirely due to direct or indirect human pressures, including alterations of water regime, conversion of land for

development, mining, agriculture, and construction of linear projects, such as highways or canals (California Department of Fish and Wildlife 2015).

Disruption of natural successional dynamics is an important stress that occurs due to inhibition of natural succession or repeated human disturbances. Disruption of natural processes, such as fire, prevents the regeneration of early successional species. Agriculture, timber harvest, and heavy recreational uses can interrupt the establishment of late successional species, which are typically less tolerant of disturbance and require longer periods to become established (California Department of Fish and Wildlife 2015).

Changes in habitat can reduce its suitability for some species and may be a less detectable type of habitat loss. Invasive species in grass/forb communities such as cheatgrass, medusahead, and other nonnatives are a concern due to adverse effects on habitat quality and availability. Climate change may exacerbate some of these issues, including the spread of invasive species and conversion of vegetation that provides habitat (Bradley et al. 2016).

PARASITES/PATHOGENS

Growth, development and resulting infrastructure bring humans and domesticated animals in contact with wildlife and ecosystems, potentially introducing harmful plants, animals or pathogens to ecosystems and species. Parasites, pathogens and diseases that affect wildlife populations may be released directly or indirectly due to human activities (California Department of Fish and Wildlife 2015). For example, detection of exotic lice at Point Reyes

National Seashore (Marin County) and Lake Pillsbury (Lake County) constitutes a potential adverse impact to California's elk. Further investigations to determine prevalence and 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 prey on elk calves. The best available scientific information suggests that wolves preferentially prey on elk populations when present and on deer in the absence of elk. With the arrival of wolves in northern California in 2014, there is concern that wolves alone or in combination with other predators could significantly affect elk populations and possibly extirpate local populations of elk. In a study conducted in Alberta, Canada, Webb et al. (2009) suggested that the numerical response of wolves to increases in white-tailed deer may intensify the effects of wolf predation on secondary prey such as elk. They reported the effect of wolf predation on elk depends on many factors, several of which were not addressed in their study (Webb et al. 2009). If the number of wolves in California increases based on the availability of prey such as black-tailed deer or mule deer, then predation on elk may increase or limit potential for the elk population to increase and expand. It seems likely such a scenario would particularly affect small elk herds recently reestablished through translocation or natural movements.

Wolves in California are most likely to select Roosevelt elk and black-tailed deer as prey 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 habi-

tat. Even though elk are expanding in California, currently they have not filled in their historical range, leaving suitable areas unoccupied. This includes the small groups or subpopulations of Rocky Mountain and Roosevelt elk established since the 1980s that have been slowly increasing and expanding within their historical range. Tule elk, which occur further south, could become vulnerable to predation if wolves were to move south into tule elk range.

The Conservation Plan for Gray Wolves in California Part II (Kovacs et al. 2016) includes strategies to achieve goals articulated in the plan. Several strategies directly pertain to elk and other ungulates (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 rates of adult females below 80% for elk (over three consecutive years), or
- 25% or more population reduction in elk herds over three consecutive-years of monitoring, or
- Elk calf:cow ratios fall below 20:100 (over three consecutive-years), or
- Reduction, due to wolves, of allocated big game tags to below current levels (2018) in areas occupied by wolves.

For a given EMU, surpassing any of these thresholds may indicate a declining population and management actions may be triggered 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 include improving habitat conditions and managing specific causes of ungulate, especially elk, mortality. If poor ungu-

late 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 land-owners to address habitat conditions in need of improvement.

CLIMATE CHANGE

Changes in climate and related 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, existing information suggests both adverse and beneficial effects, depending on a variety of local/regional factors such as latitude, elevation, topography and aspect. 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 could reduce 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).

The extent to which climate change plays a role 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 affect ungulates (Moser et al. 2009,

Mysterud 2013). The Department will use adaptive management to track climate change data and continually improve model predictions for the future.

Elk occupy a wide variety of habitats in California. 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 on elk in California cannot be forecast due to the wide distribution and variety of habitats utilized by elk, and the uncertainty of future climatic effects on wildlife habitat, precipitation, and distribution of the resources elk depend on. 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 adverse effects of climate change are detected (Inkley et al. 2013).

B. Research Needs to Inform Management

The Department has identified the following research and information needs to assist the Department in making management decisions.

POPULATION MONITORING

Reliable estimates for populations of animals such as elk are needed to assess their status (Klein 1972, Rocky Mountain National Park 2012, Deerhake et al. 2016), understand factors related to their persistence (Berger 1990, Harris et al. 2007), and develop strategies for their conservation (Bleich et al. 1990, Huber et al. 2011). 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, Bender et al. 2003). Each technique includes biases that potentially affect survey results (Caughley 1974, McCullough et al. 1994, McCorquodale 2001, Schoenecker and Lubow 2016). For example, results obtained from simultaneous ground and aerial surveys can differ greatly for the same population of ungulates (Gilbert and Grieb 1957, Caughley 1974, Samuel et al. 1987, Bender et al. 2003). Determining the most appropriate survey technique for an individual EMU is important 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 include an enhanced ability to obtain larger sample sizes, identify and classify a larger proportion of animals 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 coopera-

tion among agencies, Tribes and private landowners. 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 conducted through a combination of aerial and road surveys 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 the mid-1980s and again in 2008, the Department flew helicopter surveys for the Owens Valley in Inyo County and the San Luis Reservoir area of Merced County respectively, then surveyed the same areas several 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 those conducted with a 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 with costs likely to increase in the future. This technique is also dangerous, as evidenced by fatalities of biologists nationwide from accidents. It is not clear that the same technique should be used for every EMU in California. Instead, 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 can be used to identify individual elk and determine gender (Luk-



acs and Burnham 2005, Brinkman and Hundertmark 2009, Brinkman et al. 2011). The recent development of fecal DNA-based 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 Roosevelt and Rocky Mountain elk. Initial individual identification using DNA is considered a “capture” and subsequent identifica-

tion of the same individual is a “recapture.” This CMR method allows a statistical population 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 and Roosevelt elk (Waits and Paetkau 2005, Meredith et al. 2007, 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, Del Norte, Glenn, Humboldt and Lake counties.

Unmanned aerial vehicle (UAV) technology is a new tool for surveying wildlife (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 aerial wildlife surveys. The Department has actively pursued use of UAV technology 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 of detailed reconnaissance and verification of elk distribution and population assessment within and adjacent to the Carrizo Plains Ecological Reserve in San Luis Obispo County. 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 also identified limitations of UAVs compared to traditional aerial surveys. The area surveyed utilizing the UAV is much smaller than the area surveyed utilizing traditional aerial surveys 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. The Department continues to evaluate the efficacy of conducting surveys for elk and other ungulates using UAVs.

SUBSPECIES DISTRIBUTION

All three elk subspecies are believed to be expanding their distributions and abundance within California. However, due to the rugged terrain and characteristic low visibility of the habitats where Roosevelt elk occur, their distribution is not completely known (Lowell 2010, California Department of Fish and Wildlife, unpublished data). Additional monitoring with satellite telemetry collars would assist the Department in acquiring information on both distribu-

tion and connectivity between populations of elk and may help determine if range shifts are occurring because of climate change.

Sightings of elk outside of existing known ranges are reported to the Department on a regular basis (California Department of Fish and Wildlife, unpublished data). These reports originate from the 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 movements is important 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, NPS, CDPR, private and tribal. A variety of lands and associated habitats owned and managed by Tribes occurs throughout California. 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. The extent to which elk persist on tribal lands throughout California needs to be better described. Moreover, Tribes have expressed interest in re-introducing elk on tribal lands within historical elk range.

CONNECTIVITY/FRAGMENTATION

Loss of landscape connectivity and habitat fragmentation 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). For this reason, California's State Wildlife Action Plan (California Department of Fish and Wildlife 2015) contains a specific goal to maintain and improve wildlife corridors and genetic diversity (Goal 2.1, Connectivity). Mammals such as elk require large interconnected regions to maintain the genetic diversity of healthy populations (Kucera 1991, Lyon and Christensen 2002, Williams et al. 2004, Cronin et al. 2008). Because of translocation efforts and natural dispersal, the status of California's three elk subspecies has improved since 1970. This improvement is evidenced by population surveys and GPS collar distribution studies (California Department of Fish and Wildlife, unpublished data). With continued range expansion, this trend should continue. However, geographic barriers and urbanization may isolate some high priority areas. Because tule elk population numbers declined so sharply prior to the 1870s (Kucera 1991, Williams et al. 2004), research and information on maintaining and enhancing habitat connectivity continues to be important to inform management.

EMU documents (Appendix E) discuss population viability, genetic diversity and connectivity for each high priority area in Figure 7. The Department has documented movement of individuals between adjacent EMUs in many instances. However, tule elk in northern EMUs (Mendocino, Lake Pillsbury, East Park Reservoir, Bear Valley and Cache Creek) are isolated from those in the central-southern EMUs (Figure 7). Additionally, tule elk in the Point Reyes, Grizzly Island and Owens Valley EMUs are completely isolated from other EMUs, and Rocky Mountain elk in the Tejon EMU are isolated from other EMUs containing Rocky Mountain elk in northeastern California.

California's State Wildlife Action Plan identifies land acquisitions, easements and leases as appropriate strategies to maintain and enhance habitat connectivity (California Department of Fish and Wildlife 2015). Identification of existing elk movement corridors and prioritization of efforts to enhance habitat connectivity and genetic diversity for the future are important. For isolated EMUs (Grizzly Island, Owens Valley, Tejon and confined herds), periodic translocations can help to overcome lack of functional corridors for the near future. This is especially true for the Grizzly Island EMU as highways through and around the Bay-Delta (I-80, I-680, I-580, I-5) prohibit natural dispersal.

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 (including prescribed burning), livestock grazing and wildfire. 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 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). Forage studies from other states are also likely informative.

IV. MANAGEMENT ACTIONS

A. Strategy for Implementation and Evaluation

All management actions and the evaluation of their success will be based on population sampling methods and statistically derived population estimates, when available. Design and establishment of consistent, repeatable survey techniques including aerial, ground, and alternative methods under development will provide 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 GPS-collared elk in order to track distribution and movement across habitat types. Individual herds will also be monitored with GPS collars and radio telemetry to detect dispersal and movement of elk in an effort to identify isolated subherds.

2. Habitat Conservation Actions

Habitat-use information from GPS and radio-telemetry 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 suitable elk habitats and assess connectivity between and within EMUs to inform identification and protection of movement corridors. In addition, long term monitoring is needed to reveal movement corridors as elk distribution and range expansion

continues. The Department will continue to work with public land agencies (USFS, BLM, NPS, USFWS, etc.) and private landowners to manage habitat for the benefit of elk.

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. The Department will evaluate expansion, modification, or addition of hunt zones based on the following criteria:

- Consistency with population and management objectives of the respective EMU document (Appendix E)
- Adequate population monitoring data are available 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 (CEQA) provisions would occur prior to implementation of any new hunting opportunities.

Allocating tag proportions through the general drawing and PLM programs is under consideration. 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 Commission.

4. Co-Management with California Tribes

The Department, as stated in its Tribal Communication and Consultation Policy, seeks and encourages a collaborative relationship with Tribes, including co-management of resources. The Department anticipates working with individual Tribes to develop co-management agreements, memoranda of agree-

ment or similar mechanisms to establish positive, cooperative relationships with Tribes for the management of elk as they move across the landscape and jurisdictional boundaries.

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 AND REVISION

Progress in achieving actions called for in this plan should be reviewed annually. If the plan is considered appropriate and adequate upon review, 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. Individual EMU plans will be updated as new information is gathered and obtained.



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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

Commission - Fish and Game Commission

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

ESU - Evolutionary Significant 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

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 Department of Agriculture Forest Service

USFWS - United States Fish and Wildlife Service

USGS - United States Geological Survey

YNP - Yellowstone National Park

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IX. APPENDICES

Appendix A: Select Sections of Fish and Game Code Pertaining to Wildlife Management and Elk (organized sequentially and excerpted from 2018 Fish and Game Code):

§13.5. Adaptive Management Defined

“Adaptive management,” unless otherwise specified in this code, means management that improves the management of biological resources over time by using new information gathered through monitoring, evaluation, and other credible sources as they become available, and adjusts management strategies and practices to assist in meeting conservation and management goals. Under adaptive management, program actions are viewed as tools for learning to inform future actions.

§325. Surplus Game Hunting Season; Establishment of

Whenever after due investigation the commission finds that game mammals, other than deer, and fur-bearing mammals and resident game birds have increased in numbers in any areas, districts, or portions thereof other than a refuge or preserve established by statute, to such an extent that a surplus exists, or to such an extent that the mammals or birds are damaging public or private property, or are overgrazing their range, the commission may provide by regulation, for a special hunting season for the mammals and birds, additional to, or concurrent with any other open season specified by law; or provide for increased bag limits; or remove sex restrictions specified by law.

§332. Elk tag; Fee

(a) The commission may determine and fix the area or areas, the seasons and hours, the bag and possession limit, and the number of elk that may be taken under rules and regulations that the commission may adopt from time to time. The commission may authorize the taking of tule elk if the average of the department's statewide tule elk population estimates exceeds 2,000 animals, or the Legislature determines, pursuant to the reports required by Section 3951, that suitable areas cannot be found in the state to accommodate that population in a healthy condition.

(b) Only a person possessing a valid hunting license may obtain a tag for the taking of elk.

(c) The department may issue an elk tag upon payment of a fee. The fee for a tag shall be one hundred sixty-five dollars (\$165) for a resident of the state, as adjusted under Section 713. On or before July 1, 2007, the commission shall, by regulation, fix the fee for a nonresident of the state at not less than one thousand fifty dollars (\$1,050), as adjusted under Section 713. The fees shall be deposited in the Big Game Management Account established in Section 3953 and, upon appropriation by the Legislature, shall be expended, in addition to moneys budgeted for salaries of the department as set forth in Section 3953.

(d) The commission shall annually direct the department to authorize not more than three elk hunting tags for the purpose of raising funds for programs and projects to benefit elk. These tags may be sold at auction to residents or nonresidents of the state or by another method and are not subject to the fee limitation prescribed in subdivision (c)

(c) All revenues from sales pursuant to this subdivision shall be deposited in the Big

Game Management Account established in Section 3953 and, upon appropriation by the Legislature, shall be expended as set forth in that section.

(e) The commission shall direct the department to annually authorize one elk tag of the total number of tags available for issuance to nonresidents of the state.

§703.3. Ecosystem-Based Management

It is the policy of the state as follows:

(a) That the department and the commission seek to create, foster, and actively participate in effective partnerships and collaborations with other agencies and stakeholders to achieve shared goals and to better integrate fish and wildlife resource conservation and management with the natural resource management responsibilities of other agencies.

(b) That the department and commission participate in interagency coordination processes that facilitate consistency and efficiency in review of projects requiring multiple permits, including, but not necessarily limited to, joint state, federal, and local permit review teams that enable early consultation with project applicants, and provide improved sharing of data, information, tools, and science to achieve better alignment of planning, policies, and regulations across agencies.

§1801. Declaration of Policy

It is hereby declared to be the policy of the state to encourage the preservation, conservation, and maintenance of wildlife resources under the jurisdiction and influence of the state. This policy shall include the following objectives:

(a) To maintain sufficient populations of all species of wildlife and the habitat necessary to achieve the objectives stated in subdivisions (b), (c), and (d).

(b) To provide for the beneficial use and enjoyment of wildlife by all citizens of the state.

(c) To perpetuate all species of wildlife for their intrinsic and ecological values, as well as for their direct benefits to all persons.

(d) To provide for aesthetic, educational, and nonappropriative uses of the various wildlife species.

(e) To maintain diversified recreational uses of wildlife, including the sport of hunting, as proper uses of certain designated species of wildlife, subject to regulations consistent with the maintenance of healthy, viable wildlife resources, the public safety, and a quality outdoor experience.

(f) To provide for economic contributions to the citizens of the state, through the recognition that wildlife is a renewable resource of the land by which economic return can accrue to the citizens of the state, individually and collectively, through regulated management. Such management shall be consistent with the maintenance of healthy and thriving wildlife resources and the public ownership status of the wildlife resources.

(g) To alleviate economic losses or public health or safety problems caused by wildlife to the people of the state either individually or collectively. Such resolution shall be in a manner designed to bring the problem within tolerable limits consistent with economic and public health considerations and the objectives stated in subdivisions (a), (b) and (c).

(h) It is not intended that this policy shall provide any power to regulate natural resources or commercial or other activities connected therewith, except as specifically provided by the Legislature.

§1802. Jurisdiction of Department

The department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. The department, as trustee for fish and wildlife resources, shall consult with lead and responsible agencies and shall provide, as available, the requisite biological expertise to review and comment upon environmental documents and impacts arising from project activities, as those terms are used in the California Environmental Protection Act (Division 13 (commencing with Section 21000) of the Public Resources Code).

§2118.2. Importation of elk into the state

Except as provided in Section 1007, it is unlawful to import any elk (genus *Cervus*) into this state. The department may import elk pursuant to Section 1007, if prior to such importation, the department issues written findings justifying the need for and explaining the purpose of the importation.

This section shall not apply to zoos certified by the United States Department of Agriculture.

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

No part of any elk horn or antler shall be removed from any live elk for commercial purposes.

§2118.4. Seizure of imported elk

The department shall seize any elk imported in violation of Section 2118.2.

§3952. Statewide elk management plan

The department shall develop a statewide elk management plan, consistent with the state's wildlife policy as set forth in Section 1801. The statewide elk management plan shall emphasize maintaining sufficient elk populations in perpetuity, while considering all of the following:

- (a) Characteristics and geographic range of each elk subspecies within the state, including Roosevelt elk, Rocky Mountain elk, and tule elk.
- (b) Habitat conditions and trends within the state.
- (c) Major factors affecting elk within the state, including, but not limited to, conflicts with other land uses.
- (d) Management activities necessary to achieve the goals of the plan and to alleviate property damage.
- (e) Identification of high priority areas for elk management.
- (f) Methods for determining population viability and the minimum population level needed to sustain local herds.
- (g) Description of the necessary contents for individual herd management plans

prepared for high priority areas.

§3953. Big Game Management Account; Use of Funds

(a) The Big Game Management Account is hereby established within the Fish and Game Preservation Fund.

(b) Except as provided in Section 709, all revenues from the sale of antelope, elk, deer, wild pig, bear, and sheep tags, including any fundraising tags, shall be deposited in the Big Game Management Account to permit separate accountability for the receipt and expenditure of these funds. Within 30 days of the date of the sale, the selling nonprofit organization shall send the department 95 percent of the total auction sale price of the tag, with an itemized receipt showing the sale price and the 5-percent reduction retained by the nonprofit organization as a vendor's fee.

(c) Funds deposited in the Big Game Management Account shall be available for expenditure upon appropriation by the Legislature to the department. These funds shall be expended solely for the purposes set forth in this section and Sections 3951 and 3952, and Chapter 5 (commencing with Section 450) of Division 1, Chapter 7 (commencing with Section 4650), and Chapter 11 (commencing with Section 4900), including acquiring land, completing projects, and implementing programs to benefit antelope, elk, deer, wild pigs, bear, and sheep, and expanding public hunting opportunities and related public outreach. Any land acquired with funds from the Big Game Management Account shall be acquired in fee title or protected with a conservation easement and, to the extent possible, be open or provide access to the public for antelope, elk, deer, wild pig, bear, or sheep hunting. The department may also use funds from the Big Game Management Account to pay for administrative and enforcement costs of the programs and activities described in this section. The amount allocated from the account for administrative costs shall be limited to the reasonable costs associated with administration of the programs and activities described in this section.

(d) The department may make grants to, reimburse, or enter into contracts or other agreements, as defined in subdivision (a) of Section 1571, with nonprofit organizations for the use of the funds from the Big Game Management Account to carry out the purposes of this section, including related habitat conservation projects.

(e) An advisory committee, as determined by the department, that includes interested nonprofit organizations that have goals and objectives directly related to the management and conservation of big game species and primarily represent the interests of persons licensed pursuant to Section 3031 shall review and provide comments to the department on all proposed projects funded from the Big Game Management Account to help ensure that the requirements of this section have been met. The department shall post budget information and a brief description on an Internet Web site for all projects funded from the Big Game Management Account.

(f) Big game projects authorized pursuant to this section are not subject to Part 2 (commencing with Section 10100) of Division 2 of the Public Contract Code or Article 6 (commencing with Section 999) of Chapter 6 of Division 4 of the Military and Veterans Code .

(g) The department shall maintain the internal accountability necessary to ensure compliance with the collection, deposit, and expenditure of funds specified in this section.

§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

(a) Except as provided in Section 4181.1, any owner or tenant of land or property that is being damaged or destroyed or is in danger of being damaged or destroyed by elk, bear, beaver, wild pig, wild turkeys, or gray squirrels, may apply to the department for a permit to kill the animals. Subject to the limitations in subdivisions (b) and (d), the department, upon satisfactory evidence of the damage or destruction, actual or immediately threatened, shall issue a revocable permit for the taking and disposition of the animals under regulations adopted by the commission. The permit shall include a statement of the penalties that may be imposed for a violation of the permit conditions. Animals so taken shall not be sold or shipped from the premises on which they are taken except under instructions from the department. No iron-jawed or steel-jawed or any type of metal-jawed trap shall be used to take any bear pursuant to this section. No poison of any type may be used to take any gray squirrel or wild turkey pursuant to this section. The department shall designate the type of trap to be used to ensure the most humane method is used to trap gray squirrels. The department may require trapped squirrels to be released in parks or other nonagricultural areas. It is unlawful for any person to violate the terms of any permit issued under this section.

(b) The permit issued for taking bears pursuant to subdivision (a) shall contain the following facts:

- (1) Why the issuance of the permit was necessary.
- (2) What efforts were made to solve the problem without killing the bears.
- (3) What corrective actions should be implemented to prevent reoccurrence.

(c) With respect to wild pigs, the department shall provide an applicant for a depredation permit to take wild pigs or a person who reports taking wild pigs pursuant to subdivision (b) of Section 4181.1 with written information that sets forth available options for wild pig control, including, but not limited to, depredation permits, allowing periodic access to licensed hunters, and holding special hunts authorized pursuant to Section 4188. The department may maintain and make available to these persons lists of licensed hunters interested in wild pig hunting and lists of nonprofit organizations that are available to take possession of depredating wild pig carcasses.

(d) With respect to elk, the following procedures shall apply:

(1) Prior to issuing a depredation permit pursuant to subdivision (a), the department shall do all of the following:

- (A) Verify the actual or immediately threatened damage or destruction.
- (B) Provide a written summary of corrective measures necessary to immediately alleviate the problem.
- (C) Determine the viability of the local herd, and determine the minimum population level needed to maintain the herd.
- (D) Ensure the permit will not reduce the local herd below the minimum.
- (E) Work with affected landowners to develop measures to achieve long-term resolution, while maintaining viability of the herd.

(2) After completing the statewide elk management plan pursuant to Section 3952, the department shall use the information and methods contained in the plan to meet the

requirements of subparagraphs (C), (D), and (E) of paragraph (1).

§12300. Application of Code; Prosecution

(a) Notwithstanding any other provision of law, the provisions of this code are not applicable to California Indians whose names are inscribed upon the tribal rolls, while on the reservation of that tribe and under those circumstances in this state where the code was not applicable to them immediately before the effective date of Public Law 280, Chapter 505, First Session, 1953, 83d Congress of the United States.

(b) No Indian described in subdivision (a) shall be prosecuted for the violation of any provision of this code occurring in the places and under the circumstances described in subdivision (a). Nothing in this section, however, prohibits or restricts the prosecution of an Indian for the violation of a provision of this code prohibiting the sale of a bird, mammal, fish, amphibian, or reptile.

Appendix B: Select Sections of the California Code of Regulations Title 14.
Natural Resources *(organized sequentially and excerpted from Title 14 language as of September 2018).*

§555. Cooperative Elk Hunting Areas.

To encourage protection and enhancement of elk habitat and provide eligible landowners an opportunity for limited elk hunting on their lands, the department may establish cooperative elk hunting areas and issue license tags to allow the take of elk as specified in Section 364, and subject to the following conditions:

(a) Definition and Scope. A cooperative elk hunting area is an area of private land located within the boundary of an area open to public elk hunting (as identified in Section 364). Minimum size of a cooperative elk hunting area shall be 5,000 acres, except that contiguous parcels of at least 640 acres in size may be combined to comprise a cooperative elk hunting area. Within an area open to public elk hunting, the number of cooperative elk hunting license tags issued shall not exceed 20 percent of the number of public license tags for the corresponding public hunt and shall be of the same designation (i.e., antlerless, spike bull, bull or either-sex) as the public license tags.

(b) Application Process. Application forms are available from the department's headquarters and regional offices. A person (as defined by Fish and Game Code Section 67) owning at least 640 acres within a cooperative elk hunting area shall be eligible to apply for a cooperative elk hunting area permit. Applicants shall designate one individual eligible to receive one elk license tag by the date indicated under subsection (3) below. Such individuals shall be at least 12 years of age and possess a valid California hunting license. A person may annually submit a cooperative elk hunting area application where they own sufficient habitat as described in subsection (a) above, for each public hunt area in which their property occurs.

(1) Applications shall be submitted to the department's regional office nearest the proposed cooperative elk hunting area. Department of Fish and Game regional offices are located as follows:

Northern California and North Coast Region, 601 Locust Street, Redding 96001 (530) 225-2300

Sacramento Valley and Central Sierra Region, 1701 Nimbus Road, Rancho Cordova 95670 (916) 358-2900

Central Coast Region, 7329 Silverado Trail, Box 47, Yountville 94599 (707) 944-5500
San Joaquin Valley and Southern Sierra Region, 1234 East Shaw Avenue, Fresno 93710 (559) 243-4005

South Coast Region, 4949 View Crest Avenue, San Diego 92123 (858) 467-4201

Eastern Sierra and Inland Deserts Region, 4775 Bird Farm Road, Chino Hills 91709 (909) 597-9823

(2) Completed applications must be received by the first business day following July 1. Only those applications that are filled out completely will be accepted. The Department will evaluate applications to determine if the specified parcels are of sufficient size within the boundary of a public elk hunt area, and contain important elk habitat. Rejected applications and those that are incomplete will be returned within 15 days of receipt by the department. If the number of accepted applications exceeds the license tags

available, the department will determine successful applicants and a list of alternates by conducting a random drawing from the pool of qualified applicants as soon as possible after the application deadline. For any license year that the demand for cooperative elk hunting license tags within an area open to public hunting (as identified in Section 364) exceeds the number of tags available, tags will be first issued to applicants that did not receive a tag the previous year. If the quota is not filled, tags will be issued to the remaining applicants by random drawing.

(3) Successful applicants will be notified by the department as soon as possible after the application deadline. Applicants shall submit the name, address, and valid California hunting license number of designated elk license tag recipients and payment of elk license tag fees by check, money order, or credit card authorization in the amount specified by subsection 702(b)(1)(L)(M), to the department's regional office nearest the proposed cooperative elk hunting area, by the first business day following August 1.

(c) An elk license tag issued pursuant to the provisions of this section is valid only during the general elk season in which the cooperative elk hunting area occurs and shall only be used on land specified in the landowner's application. License tags are not transferable.

(d) All provisions of the Fish and Game Code and Title 14, CCR, relating to the take of birds and mammals shall be conditions of all license tags issued pursuant to this section.

(e) Any permit issued pursuant to Section 555 may be canceled or suspended at any time by the commission for cause after notice and opportunity to be heard, or without a hearing upon conviction of a violation of this regulation by a court of competent jurisdiction.

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

(a) Agreements: Pursuant to the provisions of Section 3450-3453 of the Fish and Game Code, the department may enter into agreements with the United States Department of Defense to provide for the development and administration of fish and wildlife management plans and programs on military installations. Such plans and programs shall be designed to provide biologically optimum levels of fish and wildlife resource management and use compatible with the primary military use of those lands. Military lands covered by such agreements shall not be available to the general public without the consent of the commanding officer responsible for such military lands.

(b) Military Lands Fish and Wildlife Management Plan: A fish and wildlife management plan shall be submitted to the department in writing, pursuant to agreements of Section 640(a). Upon the department's approval, the plan shall be submitted to the Commission for concurrence at the next scheduled meeting. The management plan shall include, but not be limited to the following information:

- (1) A statement of management objectives;
- (2) A description of the area;
- (3) A description of the fish and wildlife resources and a statement on the condition of the habitat;
- (4) A discussion of the appropriate and non-appropriate use of the resources; and
- (5) A discussion of the projects on the area to improve habitat for fish and wildlife.

(c) Annual Review: The department shall annually review the implementation of the provisions of the management plan for each participating military installation and report its findings to the Commission annually at its February meeting. The Director of the department shall be informed annually prior to December 1 or any proposed modification of the management plan for the following calendar year. Such proposals shall include any request for the adoption of hunting and fishing regulations which may differ from those proposed by the department of the lands adjacent to the specified military installation. The department shall forward such proposals to the Commission within 60 days. Such requests shall include the following information:

- (1) Species to be regulated;
- (2) Proposed harvest regimes including areas, seasons, bag and possession limits and special conditions;
- (3) Opportunities available to the general public, if any; and
- (4) Biological data to support proposed regulations.

(d) Records: Records of the number and species of animals harvested pursuant to the management plan shall be maintained and this information shall be submitted to the department by December 1 of each year.

(e) Termination of Agreement: The commanding officer of a participating military installation or the department may terminate any agreement provided for herein upon 30 days' written notice to the Commission.

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

It is unlawful to import, or possess any hunter harvested deer or elk (cervid) carcass or parts of any cervid carcass imported into the State, except for the following body parts:

- (a) portions of meat with no part of the spinal column, brain or head attached (other bones, such as legs and shoulders, may be attached).
- (b) hides and capes (no spinal column, brain tissue or head may be attached).
- (c) clean skull plates (no brain tissue may be present) with antlers attached.
- (d) antlers with no meat or tissue attached, except legally harvested and possessed antlers in the velvet stage are allowed, if no meat, brain or other tissue is attached.
- (e) finished taxidermy mounts with no meat or tissue attached (antlers in the velvet stage are allowed if no meat, brain or other tissue is attached).
- (f) upper canine teeth (buglers, whistlers, ivories).

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 due to reduced visibility and endure damage 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.

Take under a depredation permit (FGC §4181) by any owner or tenant of land or property that is being damaged or destroyed or is in danger of being damaged or destroyed by elk may be authorized under a permit from the Department, subject to limitations.

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 enclosure. 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 enclosure. 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.

D-2

- 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 that an accidentally trapped animal will be easier to herd out of the enclosure. 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



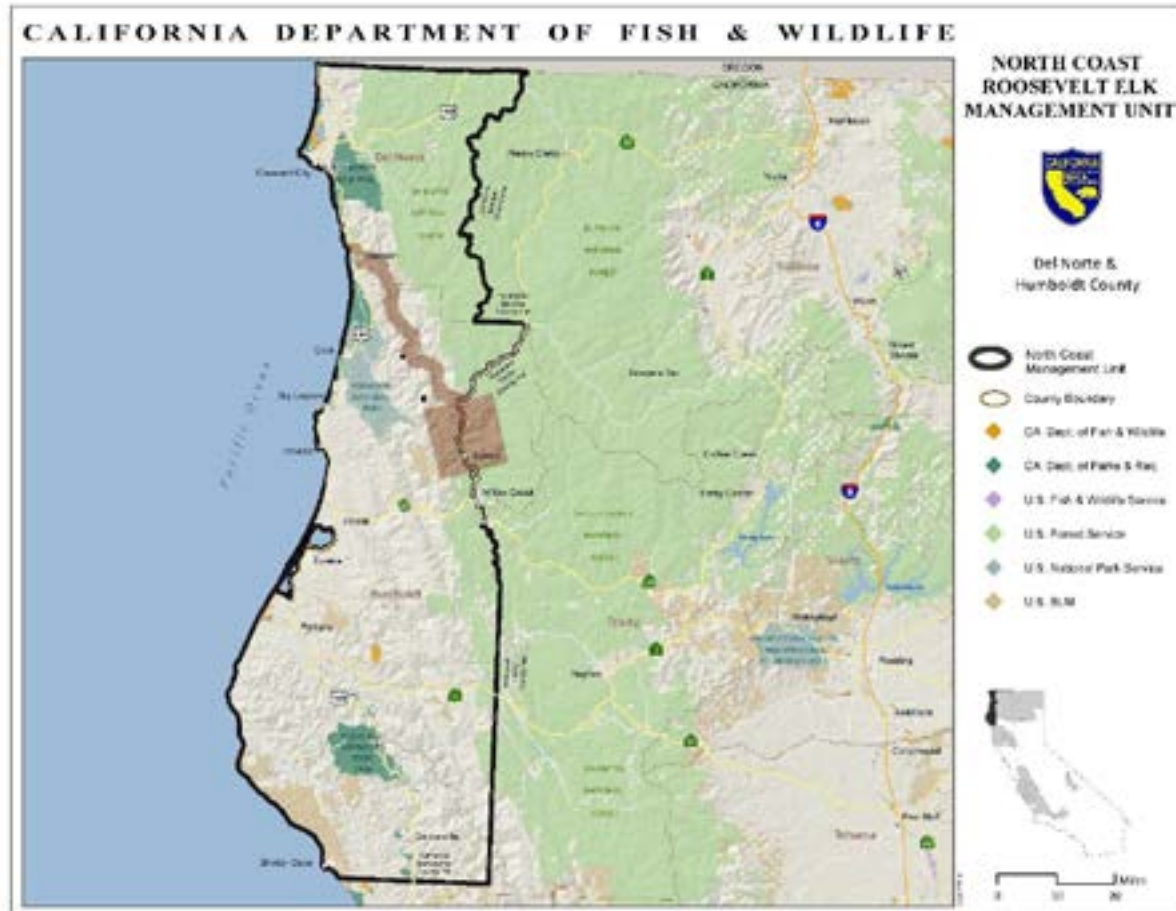
Literature Cited:

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

British Columbia Ministry of Agriculture, Food and Fisheries. 2001. Elk enclosure 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

(This EMU is considered a placeholder and starting point to initiate work with a local stakeholder group to help develop a refined plan for the 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 that 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 1925a, 1925b). 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 from 1994-1997. In 1997, Weckerly conducted a comparison of population counts (i.e., minimum population size) from a ground-based survey procedure as well as counts obtained from a Coast Guard helicopter (Weckerly and Kovacs 1998). Weckerly conducted ground-based counts and Department personnel conducted aerial surveys. Both survey approaches covered the same area (Green Diamond lands) during the same months. Further, the same number of surveys occurred from the ground and from the air. The findings indicated that aerial surveys were not effective for surveying elk in the densely canopied forests along the north coast (Weckerly and Kovacs 1998).

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 and Dr. Weckerly have 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 2016, they surveyed all groups and the total count of elk within the park was 464 individuals (Redwood National and State Parks 2017). RNSP has been using adult cow counts (includes cow, calf, and spike groups) as an indicator of persistence. The total number of cows between 2004 and 2016, in all groups in the nine years when all seven groups were counted, ranged from 316 to 365 (Redwood National and State Parks 2017).

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 not included). The CBEC herd was not counted in eight years between 1997 and 2016 due to staff and funding constraints (Redwood National and State Parks 2016). 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. Given this difficulty 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

The elk population is increasing and has not reached the upper population identified in Objective 1.7. In 2015, the Department hired staff specifically 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 stabilizing elk numbers and alleviating damage in conflict areas. This will involve a level of regulated elk hunting that promotes natural range expansion and population growth towards the upper population objective in areas without conflict and focused efforts to provide depredation relief in areas where conflicts with agriculture and/or humans reoccur.

Currently, elk appear to utilize private lands disproportionate to their availability. Expanding elk range on private land where they are tolerated is one method to increase population size. 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 and if appropriate, translocation efforts 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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 15 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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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 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.**

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. EMU population levels below the maximum population objective can occur concurrent with human-elk conflicts in a portion of the EMU that may warrant targeted management actions. The Department is committed to working with local stakeholders to address concerns over elk and human-elk conflicts and will facilitate stakeholder meetings to further refine goals and objectives.

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.

In some areas, conflicts involving adult bulls occur on private land. The Department has identified a minimum bull ratio of 15 bulls per 100 cows (objective 1.7) for this EMU. While this ratio is less than the minimum ratio for other EMUs, it is equal to or higher than those specified for many elk units in other states including Oregon (10-20 bulls per 100 cows), Washington (15-35 bulls per 100 cows), and Montana (10-20 bulls per 100 cows) (Oregon Department of Fish and Wildlife 2016, Montana Department of Fish,

Wildlife, and Parks 2004, Washington Department of Fish and Wildlife 2012). A lower bull ratio for this EMU may alleviate public safety incidents and other conflicts on private property during the rutting period, while providing sufficient bulls for breeding and viewing. The Department will monitor bull ratios and depredation complaints for this EMU to determine if additional adjustments are needed.

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 incidents of human-elk conflicts on private property by at least 25% by 2023.

Action 4.1.1

The Department will invite local, state, tribal, and federal governments, private landowners, and other interested parties to participate in a working group to address impacts to private property, improve habitat on public lands, and address other issues that involve elk management in the Unit. **Expected completion: December 2018.**

Action 4.1.2

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 4.1.3

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

Action 4.1.4

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 4.1.5

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 4.1.6

Collaborate with United States Department of Agriculture Wildlife Services, Del Norte County, 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 4.1.7

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 good. 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.

According to Meredith et al. (2007), Roosevelt elk within Del Norte and Humboldt counties should be considered an evolutionary significant unit (ESU) due to the extent of their genetic divergence from other sampled elk populations. The designation of Roosevelt elk in Del Norte and Humboldt counties as an ESU recognizes that the individuals there have less similarity and hybridization with Rocky Mountain elk than Roosevelt elk in other northern California counties. Hybridization between Roosevelt and Rocky Mountain elk was confirmed within Modoc, Shasta, and Siskiyou counties, though individuals in western Siskiyou County, west of Interstate 5, showed the same genetic character of elk in Del Norte and Humboldt counties. Interstate 5 may be a physical barrier which prevents the long distance movement for which elk are known (Meredith, et al. 2007).

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 (Commission) 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 Commission 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 Commission 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 Commission 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 Commission 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 Commission (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 2000s, 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

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Data Tables/Figures

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, 2007-2017. 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
2017	3	2	0	15	14	3	2	0
Totals	208	158	9	30	26	44	29	1
Success Rate	80%			87%		68%		

Table 6. North Coast, Reported Private Lands Management Area Harvests, 2008-2017.

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
2017	21	19	19	14	10
Total	100	68	88	56	

No PLM tags were issued until 2008.

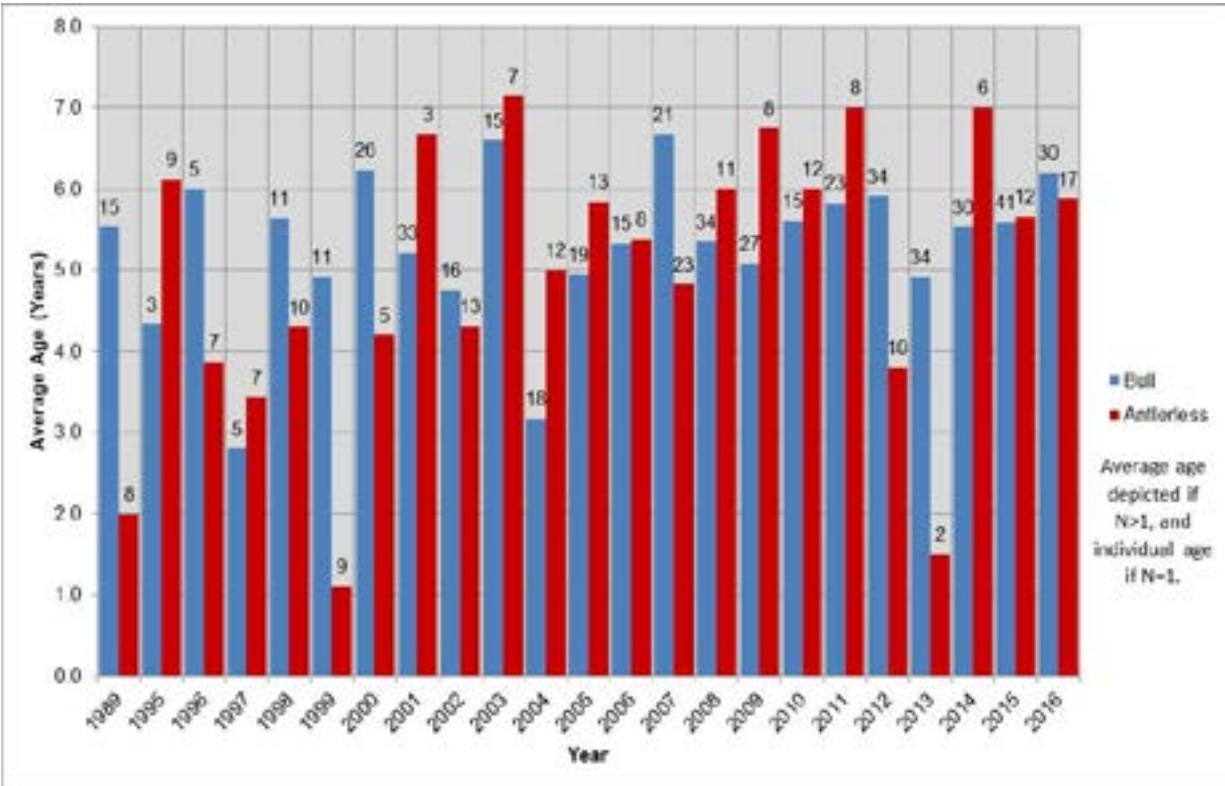
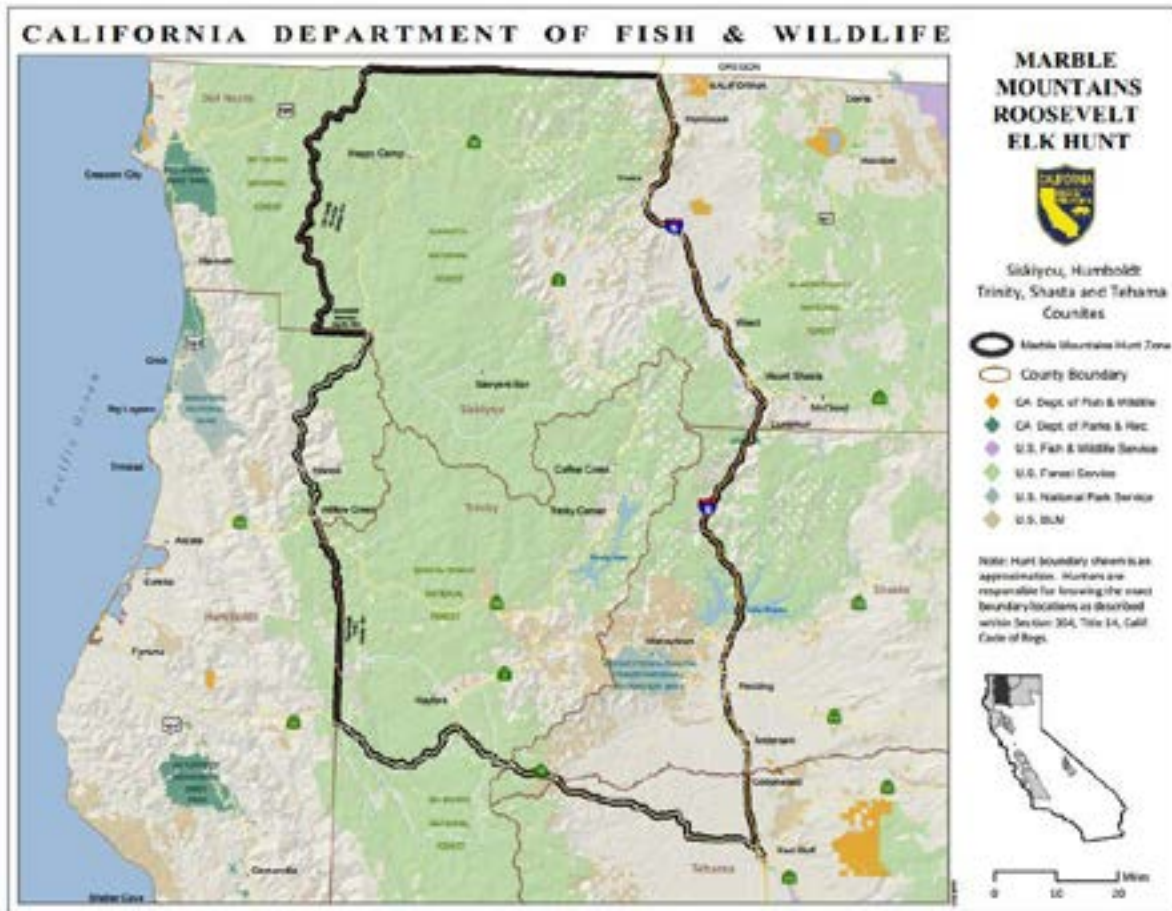


Figure 1 – Average age of harvested elk for all zones in North Coast Unit Combined. Sample sizes are denoted above bars for each year.

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 menziesii*), 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 ± 250 elk based on mark-recapture (re-sight) methods. In the early 1990's and 2000s 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. RMEF and Sierra Pacific Industries collaborated in 2016 to expand the monitoring effort and estimate age and sex ratios using infrared video cameras in Trinity County (near Douglas City and Trinity Center). Results of the video camera monitoring efforts in 2017 were as follows. For the Marble Mountain Wilderness, the observed monthly calf to cow ratio varied from a low of 12 calves per 100 cows in August to a high of 57 calves per 100 cows in May; and the observed monthly bull to cow ratio varied from a low of 3 bulls per 100 cows in March to a high of 29 bulls per

100 cows in May. For the Trinity area, the observed monthly calf to cow ratio varied from a low of 7 calves per 100 cows in October to a high 45 calves per 100 cows in July; and the observed monthly bull to cow ratio varied from a low of 4 bulls per 100 cows in June to a high of 18 bulls per 100 cows in July. It should be noted that these estimates are from small sample sizes so the confidence intervals are fairly wide.

Management Goals, Objectives, and Actions

The management goals for this Unit are to 1) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 staff specifically 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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 15 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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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 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 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 incidents 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 (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 portable 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.

Riser-Espinoza, D., and R. Nielson (in prep). Northern California elk population and recruitment study. Draft progress report prepared by WEST, Inc., Cheyenne, WY. June 11, 2018.

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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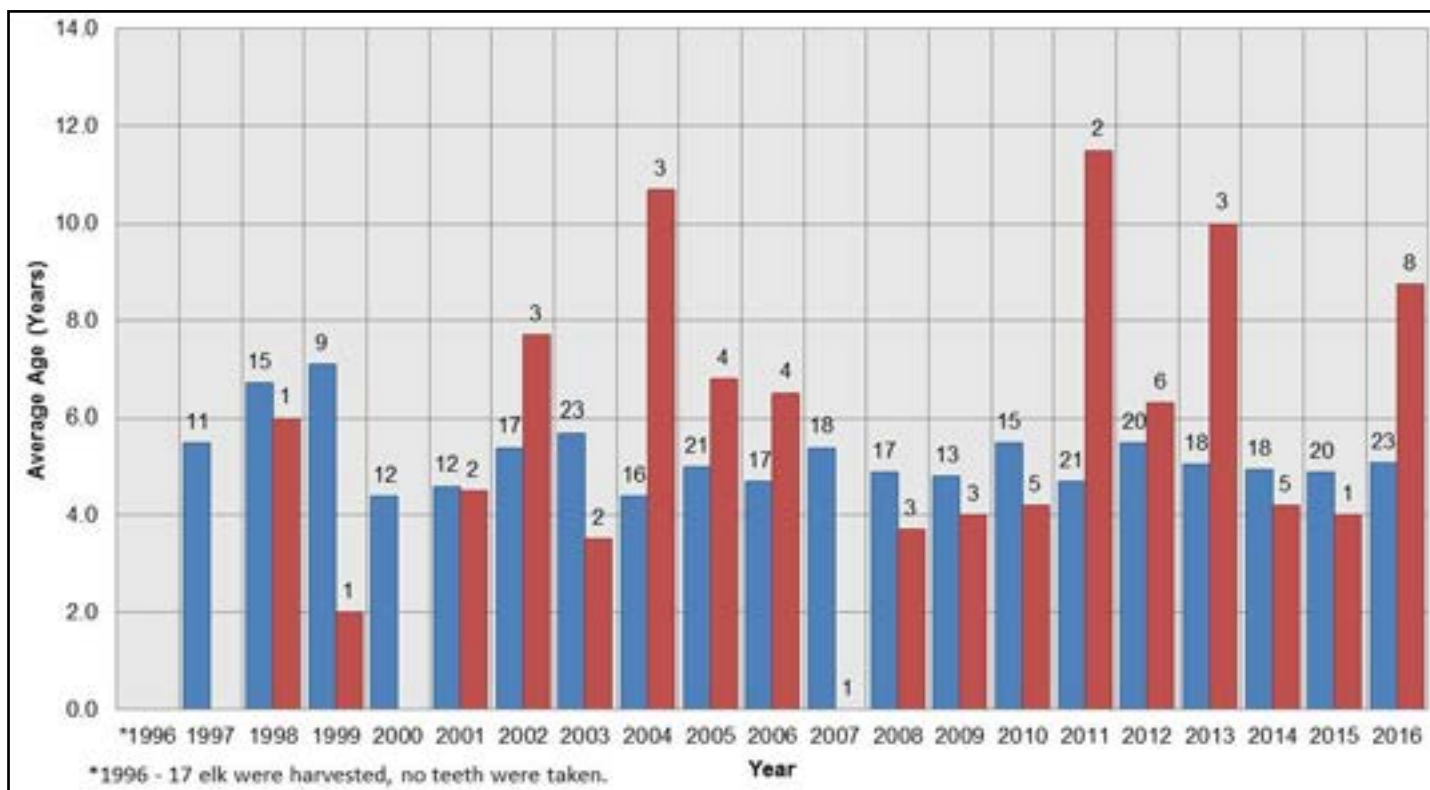
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Data Tables/Figures

Table 1. Marble Mountains Elk Unit, Public Tag Quotas and Harvests, 1996-2017.

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	
2017				1	1		5	1	3	35	12	10	4	7	4	
Totals	488	257	34	22	12	0	40	8	8	280	153	76	35	81	45	2
Success Rate	60%			55%			40%			55%		46%		58%		

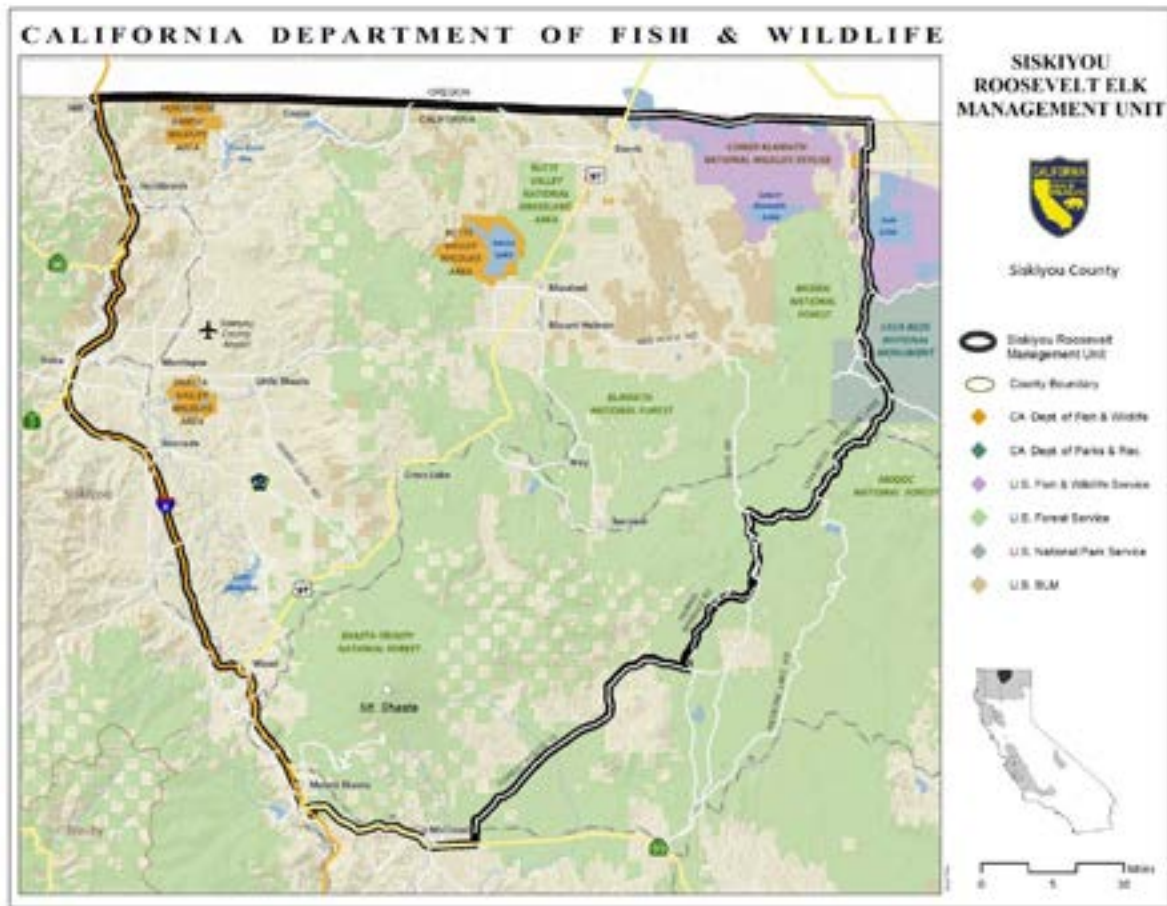


■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 1. Average age of Bull and Antlerless Elk Taken by Hunting in Marble Mountains Elk Management Unit, 1996-2016. 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 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

In consideration of current habitat capacity, other land uses, and long term environmental changes, the management goals for this Unit are to: 1) improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. Improve elk habitat conditions and population levels.

Although the Department considers the elk population to be increasing, it has not likely 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 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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the extent of hybridization, 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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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 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.**

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 incidents 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 to detect the extent of hybridization with other subspecies of elk should continue.

Summary of Annual Harvests

The Fish and Game Commission (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

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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

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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, 1986-2017.

Year	Either-Sex			Bull		Antlerless		Cooperative Elk Hunting		
	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
2017				19	9	20	8	8	2	0
Totals	481	149	44	149	105	240	82	95	33	18
Success Rate	40%			70%		34%		54%		

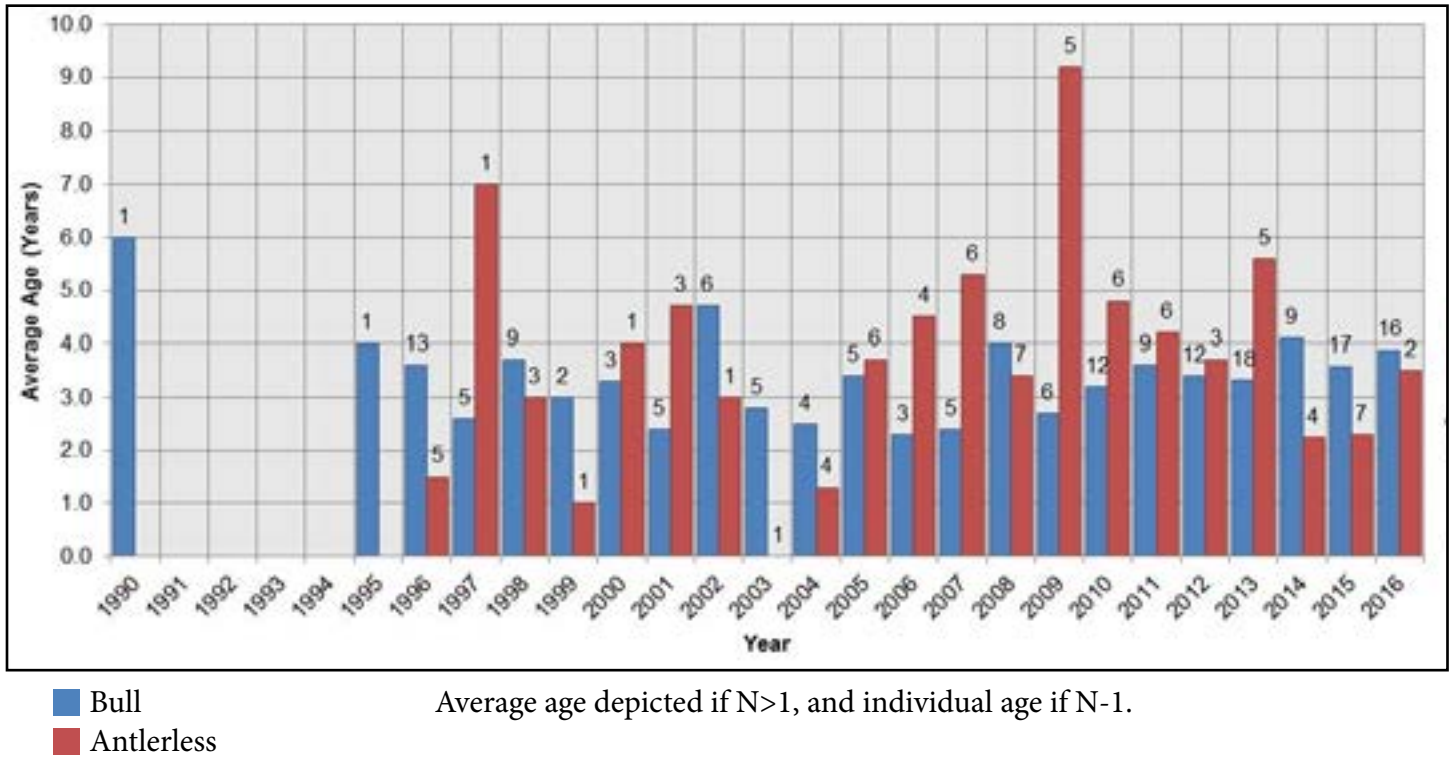
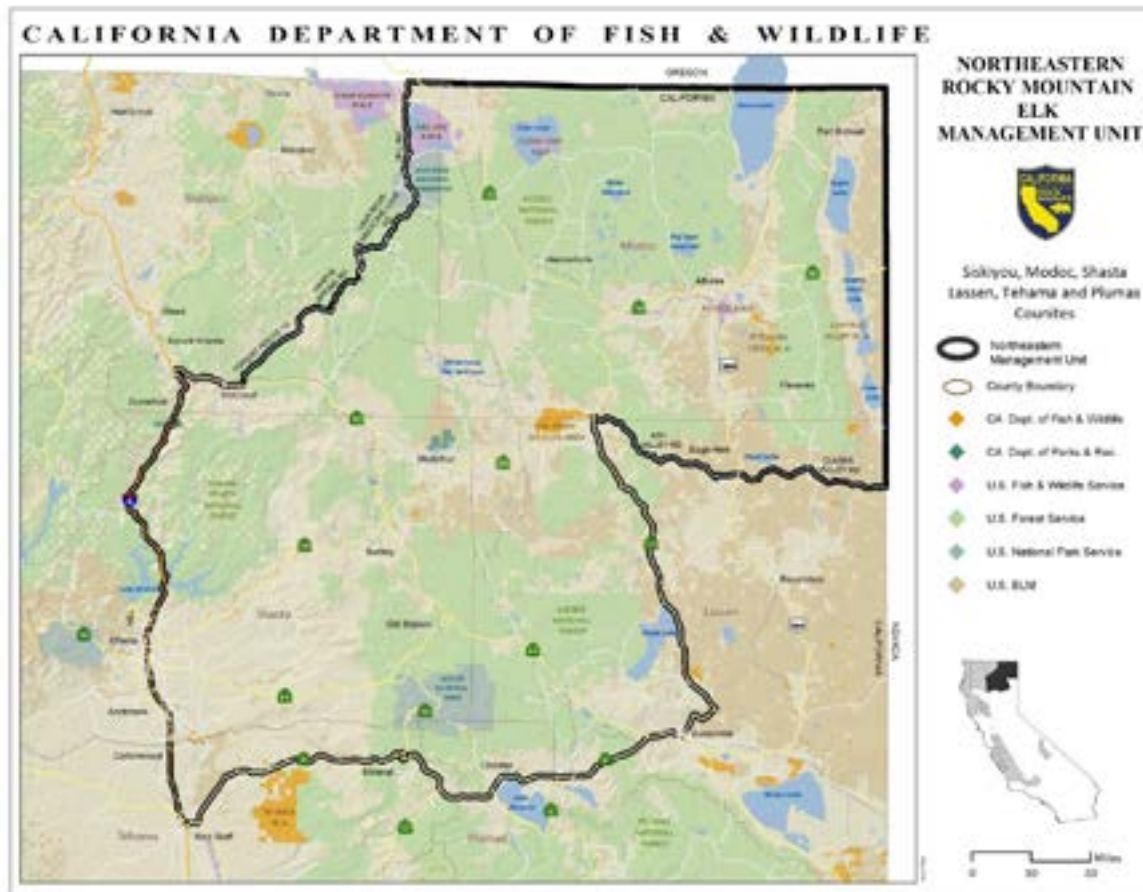


Figure 1. Average Age of Hunter Harvested Antlered and Antlerless Elk within the Siskiyou Elk Management Unit, 1990 - 2016. Sample sizes are denoted above bars for each year.

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 Tulead-Red Rock-Clarks Valley Road (Lassen County Roads 506, 512 and 510); west along the Tulead-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 established 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.

Miscellaneous groups. Groups of elk outside of identified and established subherds have been observed throughout the EMU. These include areas between subherds and portions of Lassen County. These groups are estimated between 200-250 animals.

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

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The management goals for this Unit are to 1) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 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. Collaborate with California Department of Transportation (CalTrans) to provide information and recommendations to reduce vehicle collisions by 2023.

Action 1.5.1

Examine existing elk survey data to assist in determining elk use along roadways. **Expected completion: 2021.**

Action 1.5.2

Provide recommendations to CalTrans for management actions to reduce vehicle collisions along state highways within the unit. **Expected completion: 2023.**

Objective 1.6. Identify the genetic diversity of the population and determine the extent of hybridization, 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

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

Objective 1.7. Determine habitat relationship between elk, livestock, and feral horses by 2028.

Action 1.7.1

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

Action 1.7.2

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

Objective 1.8. Maintain a population of 1,000-3,500 elk with a minimum ratio of 15 bulls per 100 cows.

Action 1.8.1

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

Action 1.8.2

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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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 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. 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 incidents 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.
- In the late 1990s, an ad hoc working group was established 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.

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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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Data Tables/Figures

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

Date	Location	Number of Elk Observed					Total	Calf:Cow Ratio	Source
		Bulls		Cows	Calves	Not Classified			
		Branched	Unbranched						
June 2015	Egg Lake					150	150		
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	
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
2016	Pondosa	279	226	1025	425	0	1955	41%	RMEF Cameras
2016	Modoc	173	383	1111	509	0	2176	46%	RMEF Cameras
2017	Pondosa	339	191	1135	548	0	2213	48%	RMEF Cameras
2017	Modoc	209	265	1053	480	0	2007	46%	RMEF Cameras

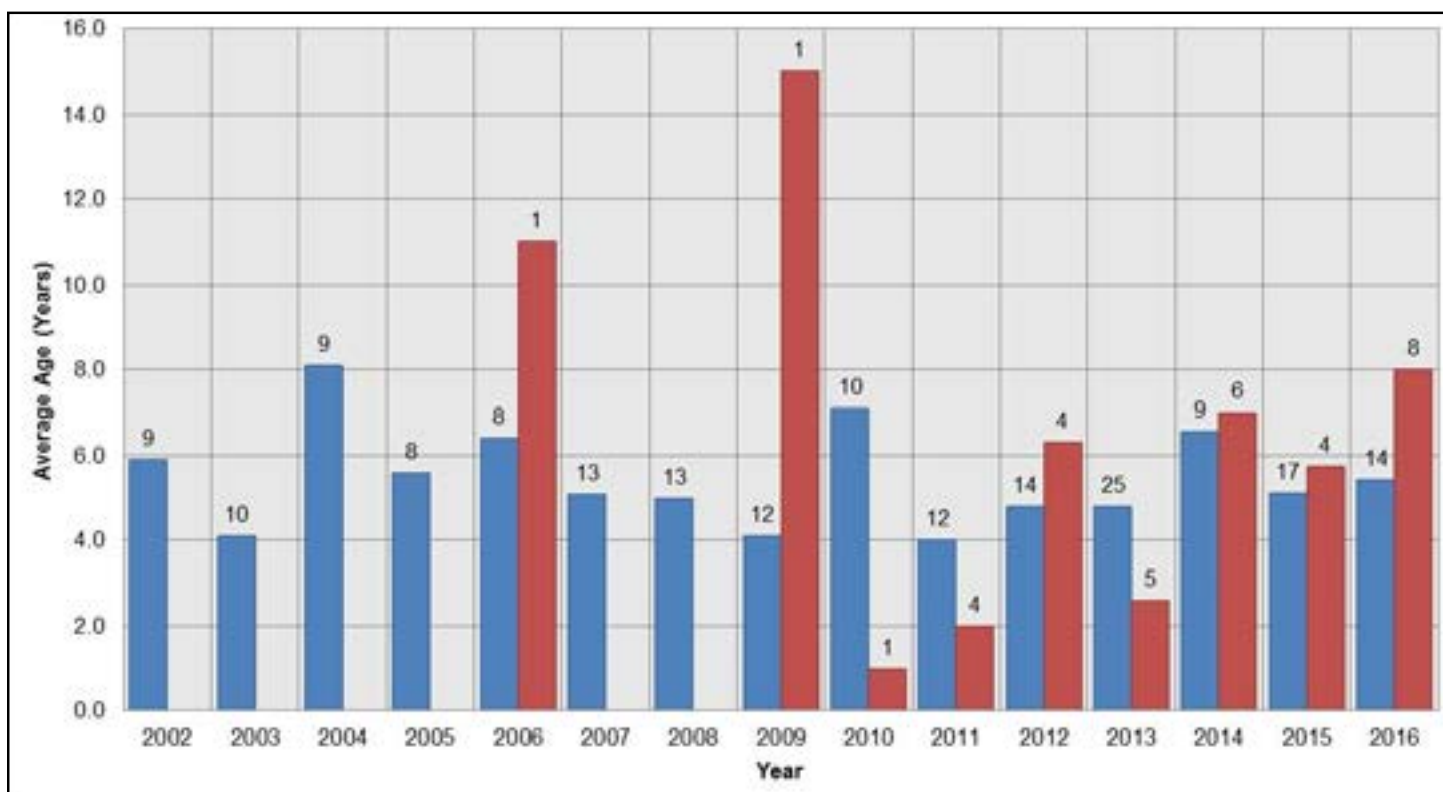
Table 2. Shasta Rocky Mountain Elk Hunt, Tag Quotas and Reported Harvests, 1969-2001.

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, 2002-2017.

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
2017				15	12	10	4	10	4		2	2		7	1	2	4	1	4
Totals	85	68	2	120	80	70	32	141	37	2	24	18	1	62	17	7	35	21	
Success Rate	82%			67%		46%		28%			79%			39%					



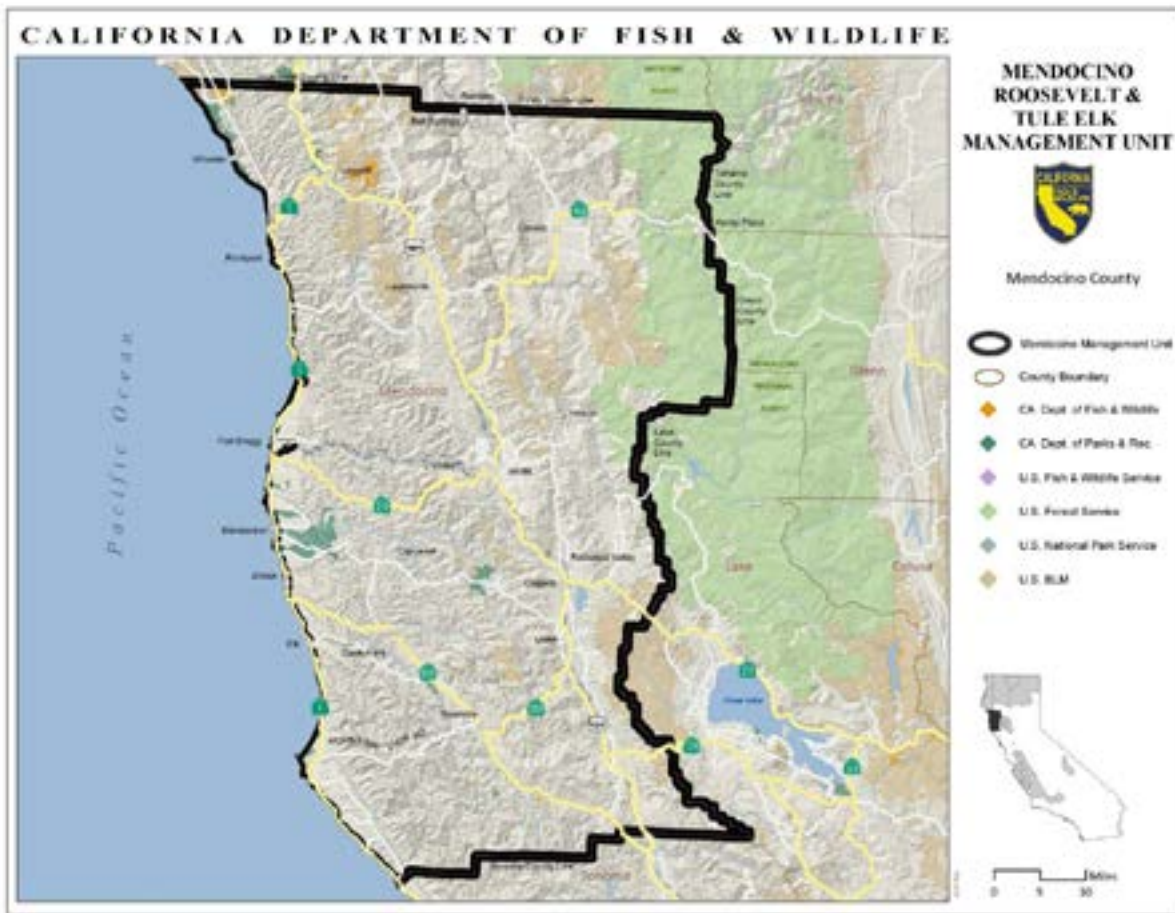
■ Bull

■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting within the Northeastern Elk Management Unit, 2002 - 2016. 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. *Nannodes* 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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. Collaborate with California Department of Transportation (CalTrans) to

provide information and recommendations to reduce vehicle collisions by 2023.

Action 1.5.1

Examine existing elk survey data to assist in determining elk use along roadways. **Expected completion: 2021.**

Action 1.5.2

Provide recommendations to CalTrans for management actions to reduce vehicle collisions along state highways within the unit. **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 200-1,000 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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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.

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.

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 2010-2017 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
2017	2	2			4	4	5	4	22	13	9
Totals	16	15	12	5	8	8	13	12	164	158	70
Success Rate	94%		42%		100%		92%				

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

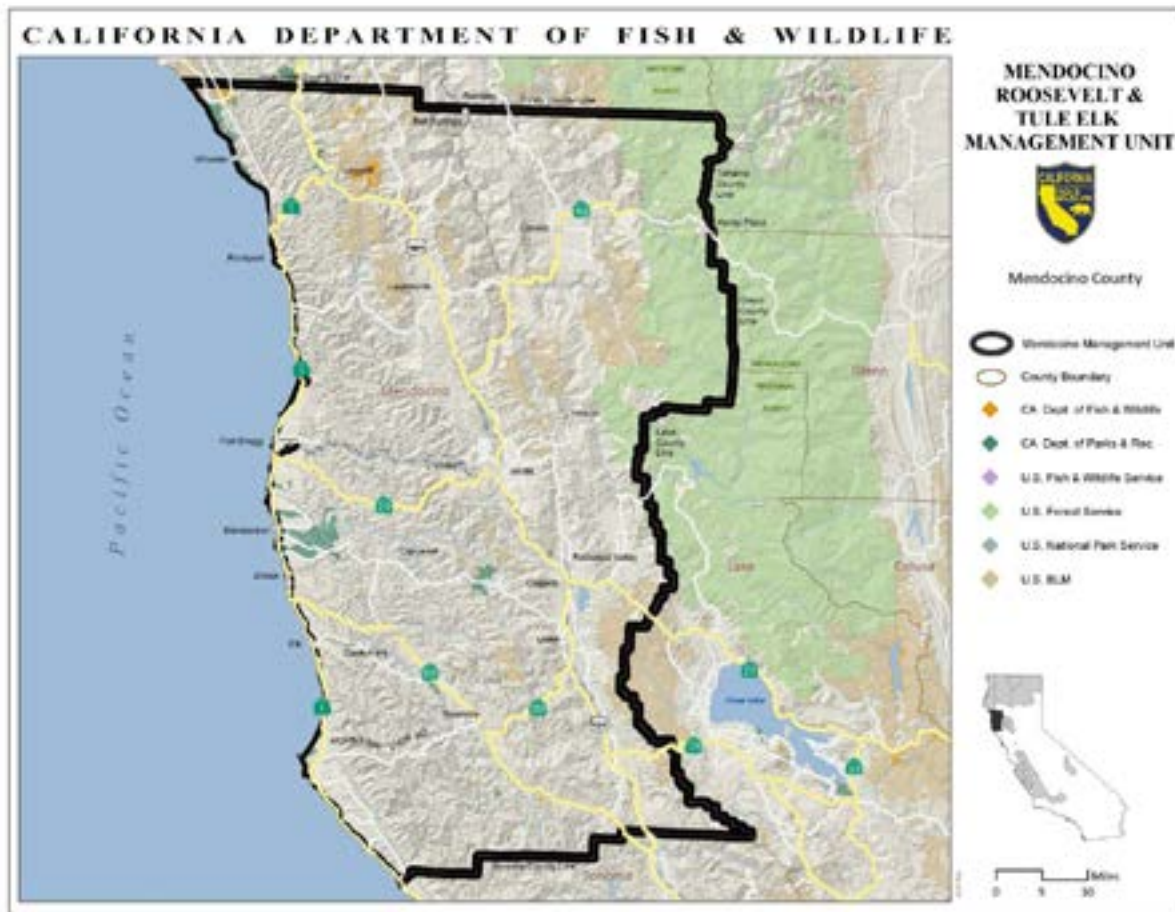
Year	Bulls	Cows	Calves	Total	Source
2000	12	43	8	63	2000 SWSP elk report by Dr. Greta Wengert
2014	11	32	5	48	2014 SWSP Elk Census by Dr. Ellie Bush
2015	10	33	10	53	2015 SWSP Elk Census by Dr. Ellie Bush

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. 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 been 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; it 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 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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. Collaborate with California Department of Transportation (CalTrans) to provide information and recommendations to reduce vehicle collisions by 2023.

Action 1.5.1

Examine existing elk survey data to assist in determining elk use along roadways. **Expected completion: 2021.**

Action 1.5.2

Provide recommendation to CalTrans for management actions to reduce vehicle collisions along state highways within the unit. **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

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 800-2,500 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 1.7.2

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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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 incidents 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 (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 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 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 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 1,100 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. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, USA.

Literature Cited:

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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	
2017	63	81	33	177	

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).

Date	Number of Elk Counted/Classified				Reported Population Size
	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).

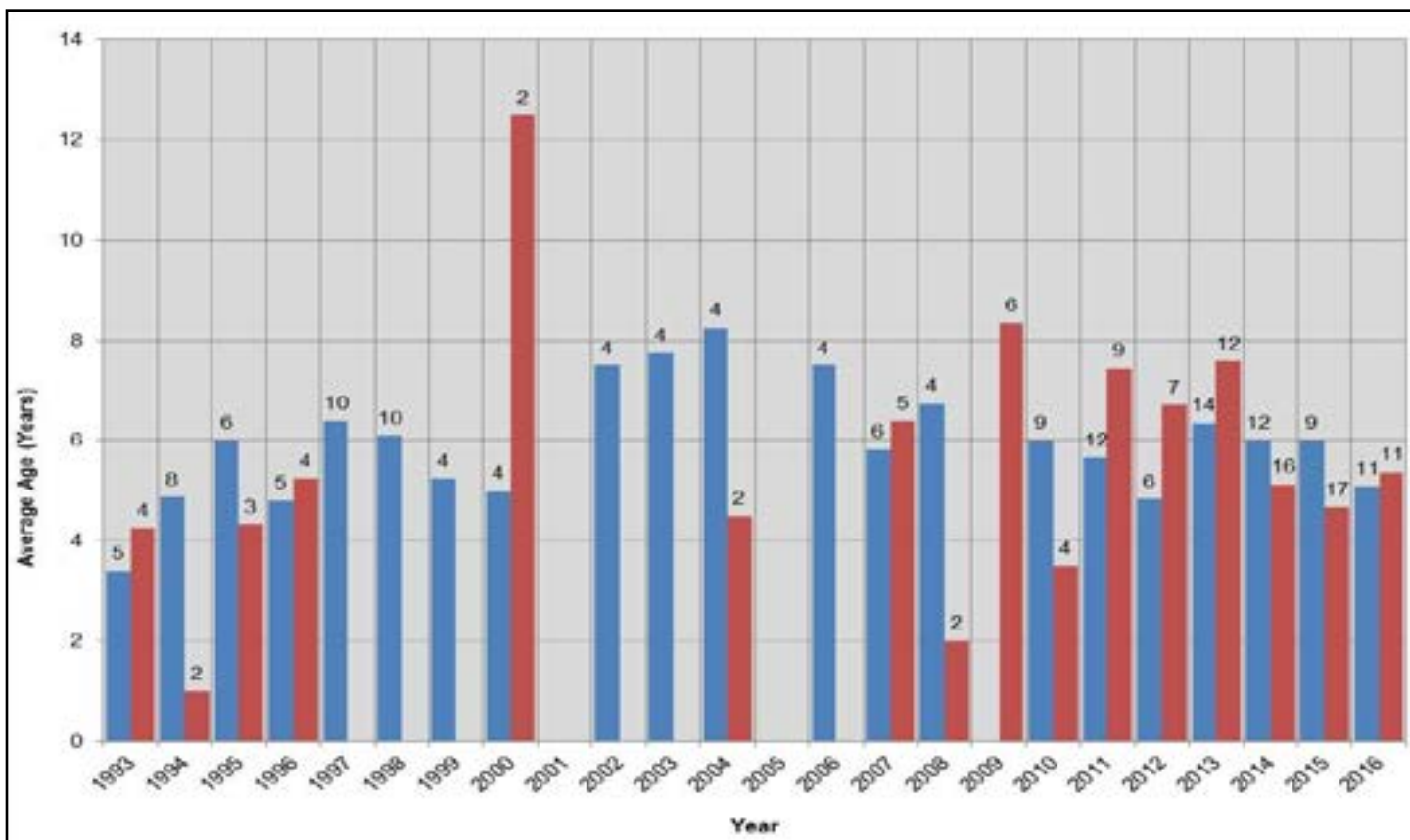
Date	Number of Elk Counted/Classified				Reported Population Size	Notes
	Bulls	Cows	Calves	Total		
1981					15-25	
1982					25-35	
1983					35-50	
1984					60-70	
1985	13-Oct	40-44	13-Oct		60-70	11 Cows Relocated from Potter Valley
1986	13-23	31-42	26-35		75-100	
1987	35-37	56-64	20-24		110-125	
1988					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, 2010-2017. 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
2017	2	2			4	4	5	4	22	13	9
Totals	16	15	12	5	8	8	13	12	320	257	
Success Rate	94%		42%		100%		92%				

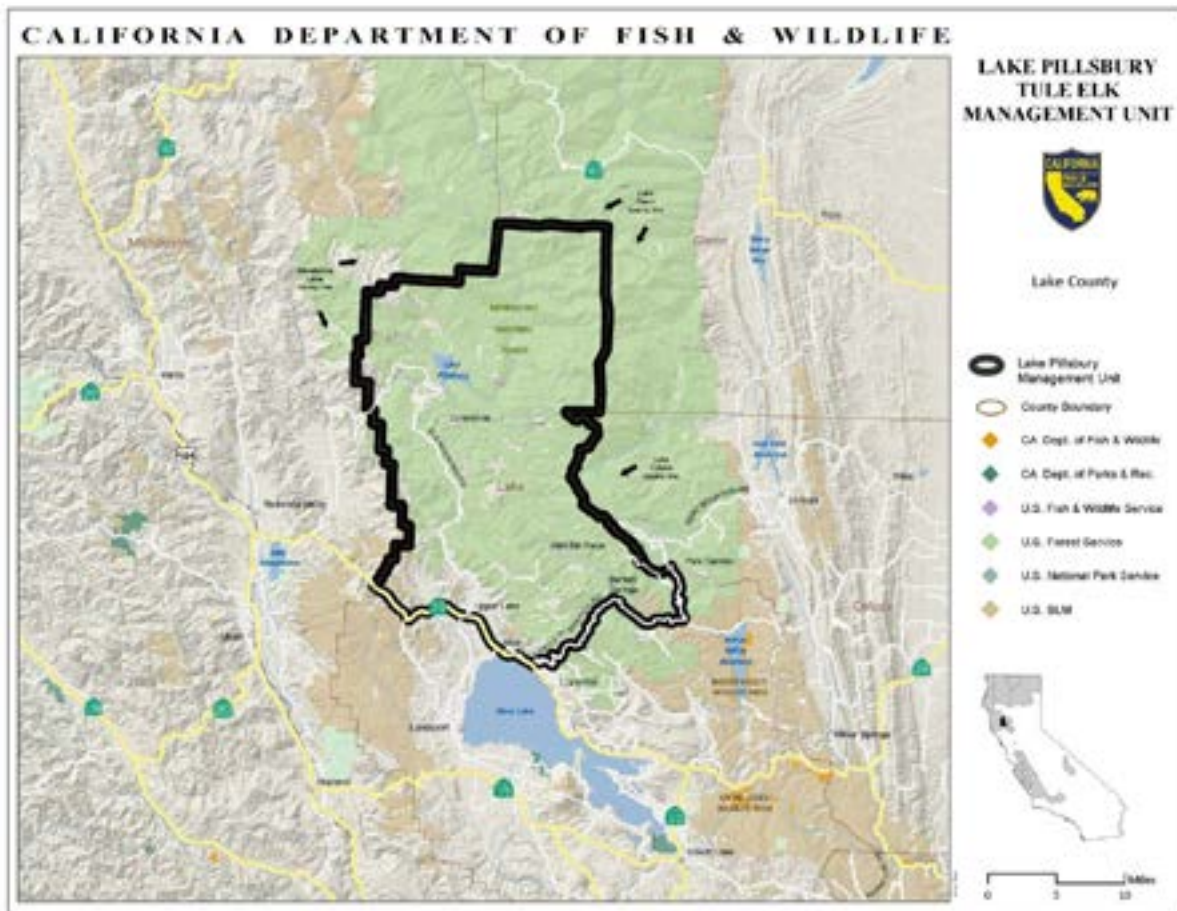


■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

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 - 2016. 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; and 2) enhance opportunities for the public to use and enjoy elk (e.g. hunting and wildlife viewing).. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the

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identified actions.

Goal 1. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the public to use and enjoy elk (e.g. 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.

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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

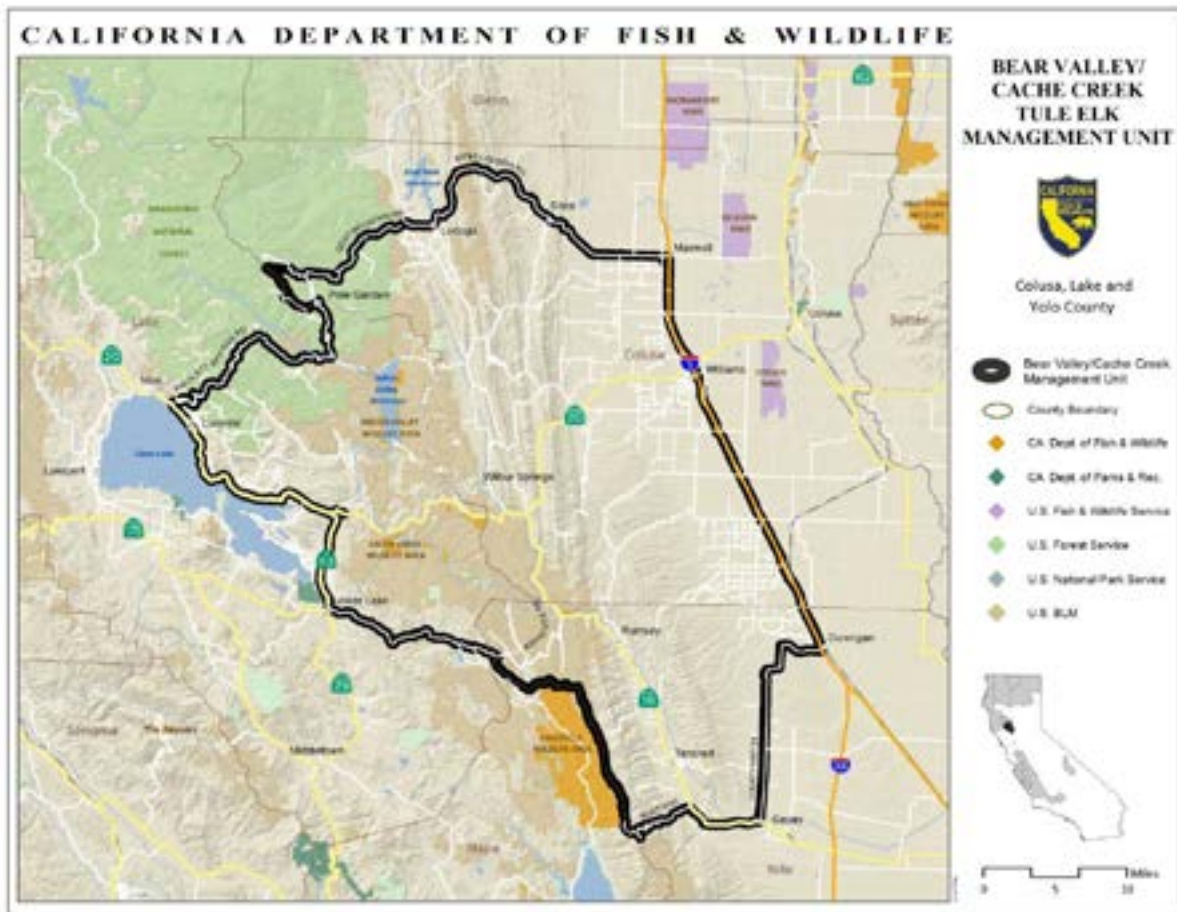
Table 1. Tule Elk Surveys for the Lake Pillsbury Tule Elk Management Unit, 2005 – 2017.

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, 2010-2017.

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
2017	2	2	4	4
Totals	16	16	26	26
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 100° 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 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 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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. Collaborate with California Department of Transportation (CalTrans) to provide information and recommendations to reduce vehicle collisions by 2023.

Action 1.5.1

Examine existing elk survey data to assist in determining elk use along roadways. **Expected completion: 2021.**

Action 1.5.2

Provide recommendations to CalTrans for management actions to reduce vehicle collisions along state highways 16 and 20 within the unit.

Expected completion: 2023.

Objective 1.6. Determine genetic diversity of the population 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 150-450 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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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 incidents 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

Booth, J.W., and E.C. Roberts, Jr. 1973. Unpublished report. California Dept. of Fish and Game.

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McLean, D.D. 1930. Unpublished report. California Department of Fish and Game.

O'Connor P.M. 1988. Home range and habitat use by tule elk at Cache Creek, California. Thesis, Humboldt State University, Arcata, California, USA.

Smith, E.S. 1973. Effects of three possible reservoir development projects on the Cache Creek tule elk herd. Administrative Report No. 73-2. California Department of Fish and Game, Environmental Services Branch, 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.

Krawchuk, M.A., and M.A. Moritz (Simon Fraser University; University of California, Berkeley). 2012. Fire and Climate Change in California. Publication number: CEC-500-2012-026. California Energy Commission, Sacramento, USA

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 subgroup
	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.

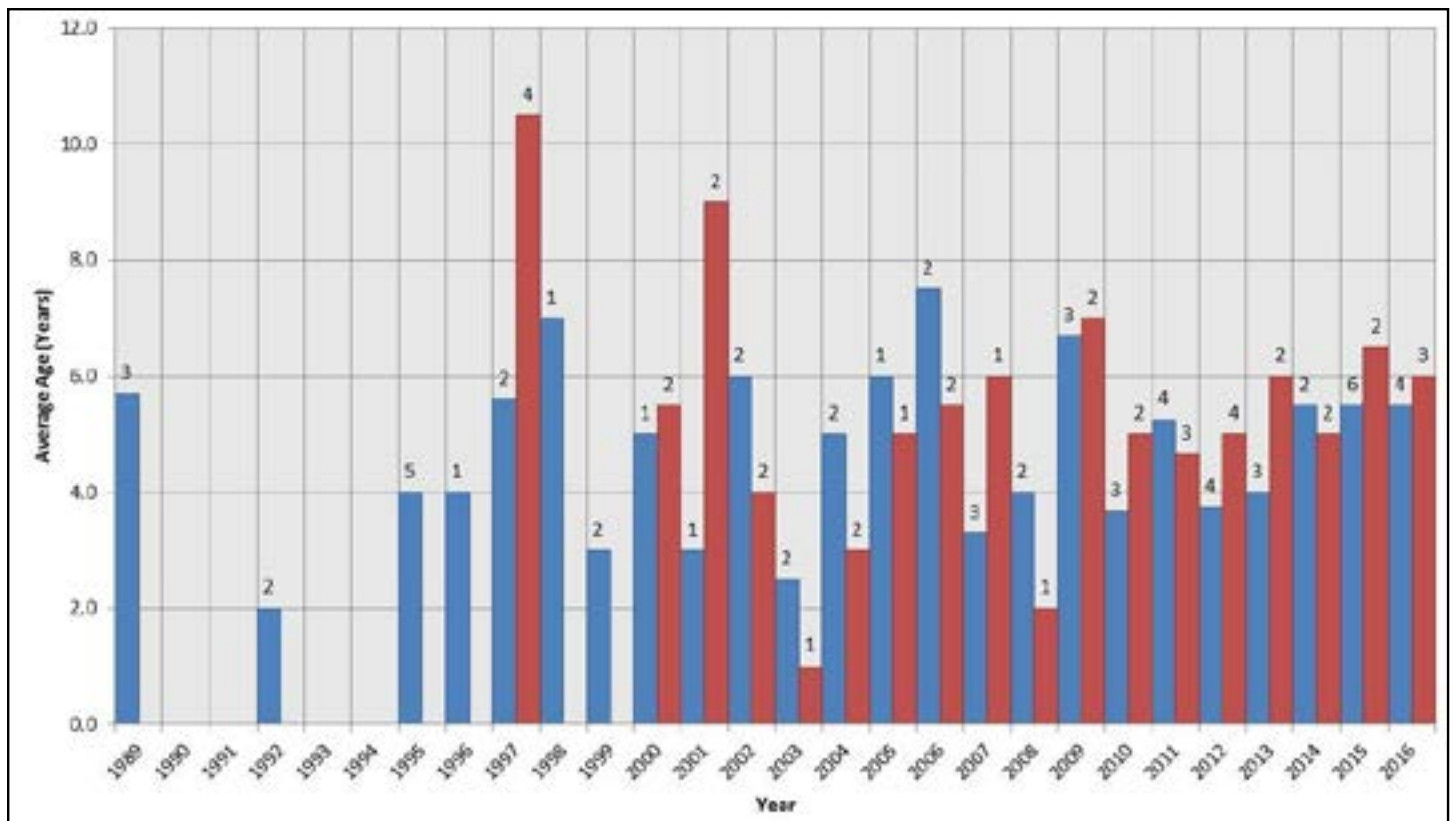
Date	Event
Feb. 1995	10 cow elk relocated to Cache Creek from San Luis National Wildlife Refuge (NWR).
Nov. – Dec. 1996	9 cow elk relocated to Cache Creek from Tupman.
Jan. 1998	2 cows, 3 sub-adult cows, 1 male calf, 1 female calf relocated to Cache Creek from Tupman.
Jan. 2001	2 cows, 4 bulls relocated 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, 1989-2017.

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
2017				2	2	2	1	1	1
Totals	15	7	0	63	55	54	41	11	10
Success Rate	47%			87%		76%		91%	

Table 4. Bear Valley Tule Elk Hunt, Public Tag Quotas and Harvests, 2010-2017.

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
2017	2	2	1	1
Totals	12	11	9	5
Success Rate	92%		56%	

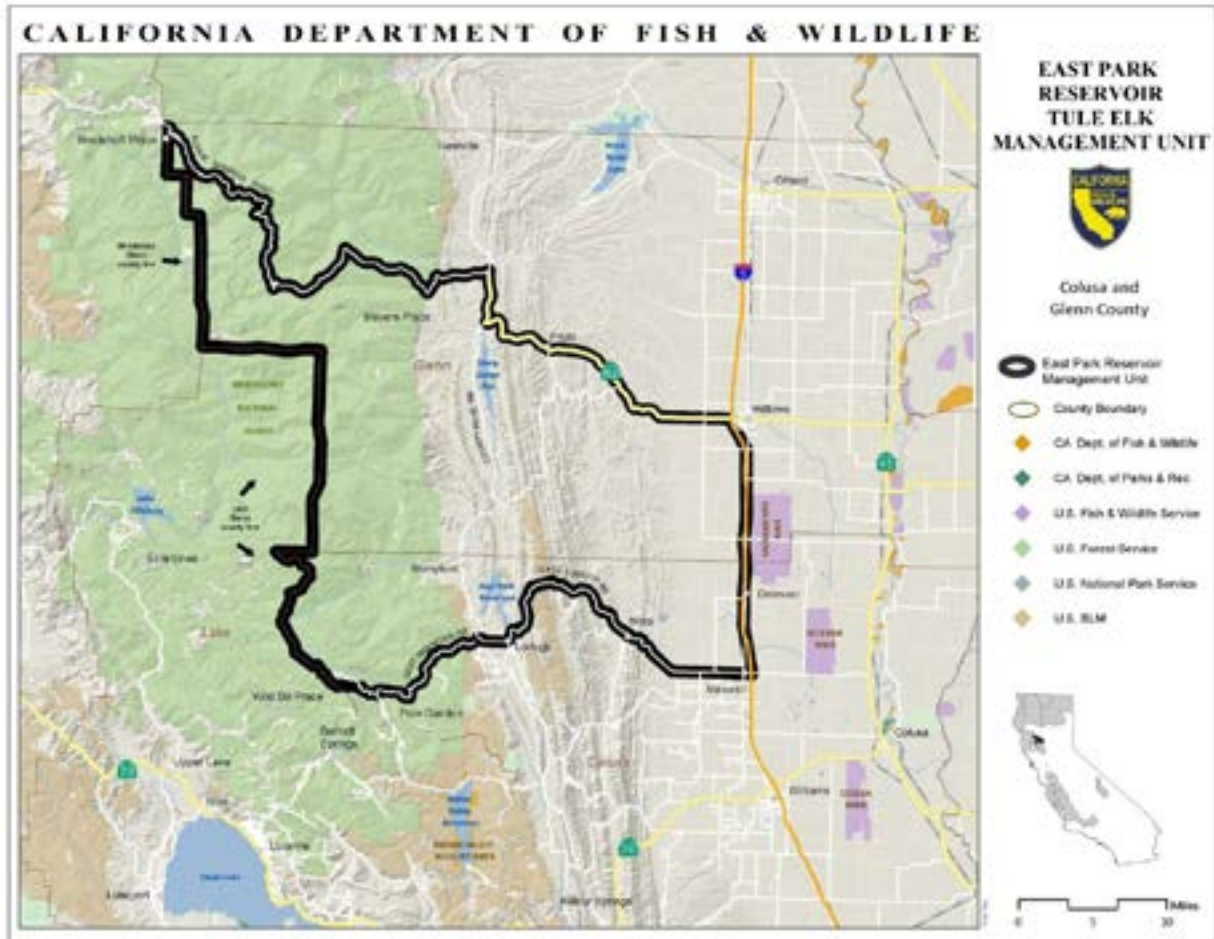


■ Bull
■ Antlerless

Average age depicted if N>1, and individual age if N=1.

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting within the Cache Creek/Bear Valley Tule Elk Management Unit, 1989-2016. 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 20 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. There 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the public to use and enjoy elk (e.g. 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 incidents 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:

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- 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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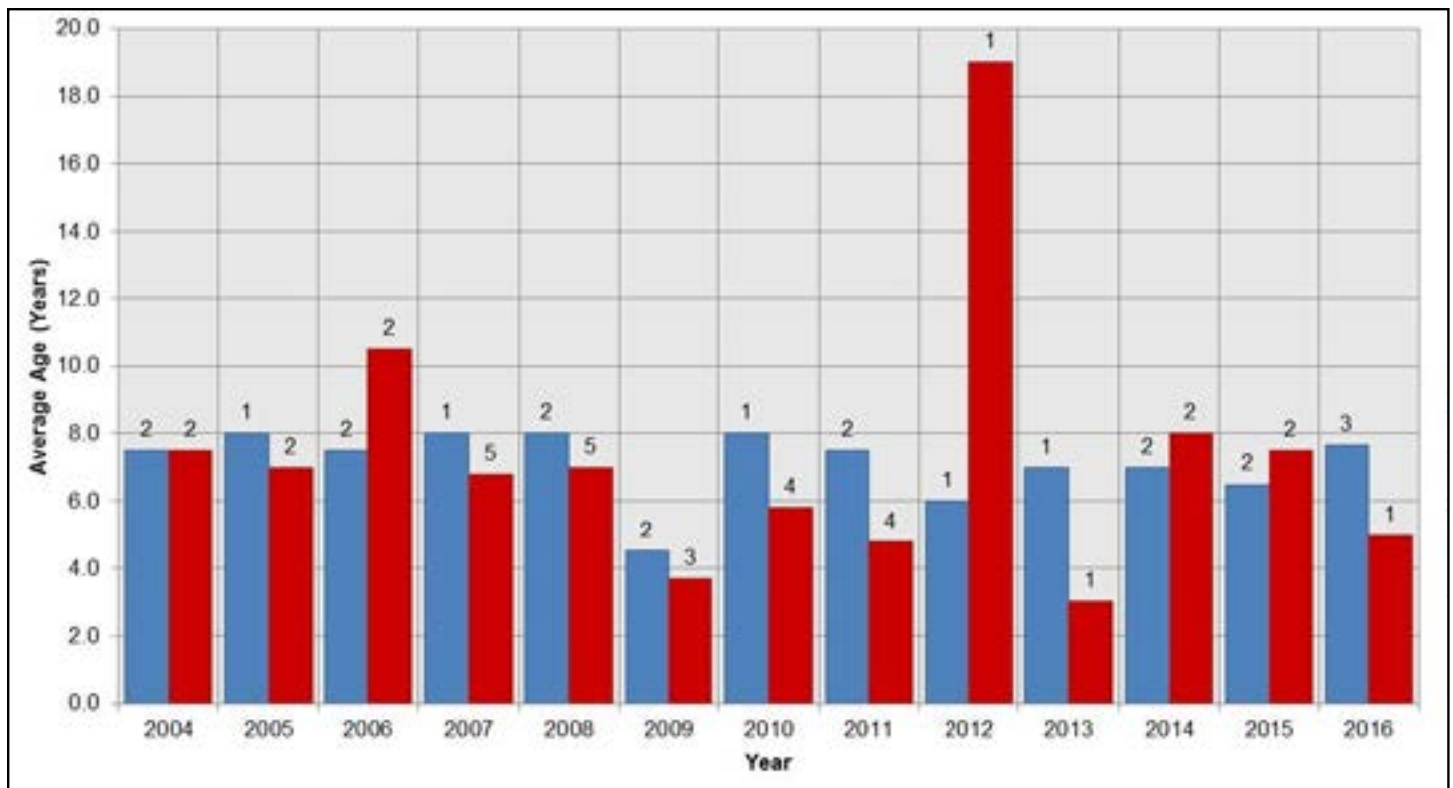
Data Tables/Figures

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, 2004-2017.

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
2017	2	2	2	2
Totals	28	28	42	38
Success Rate	100%		90%	

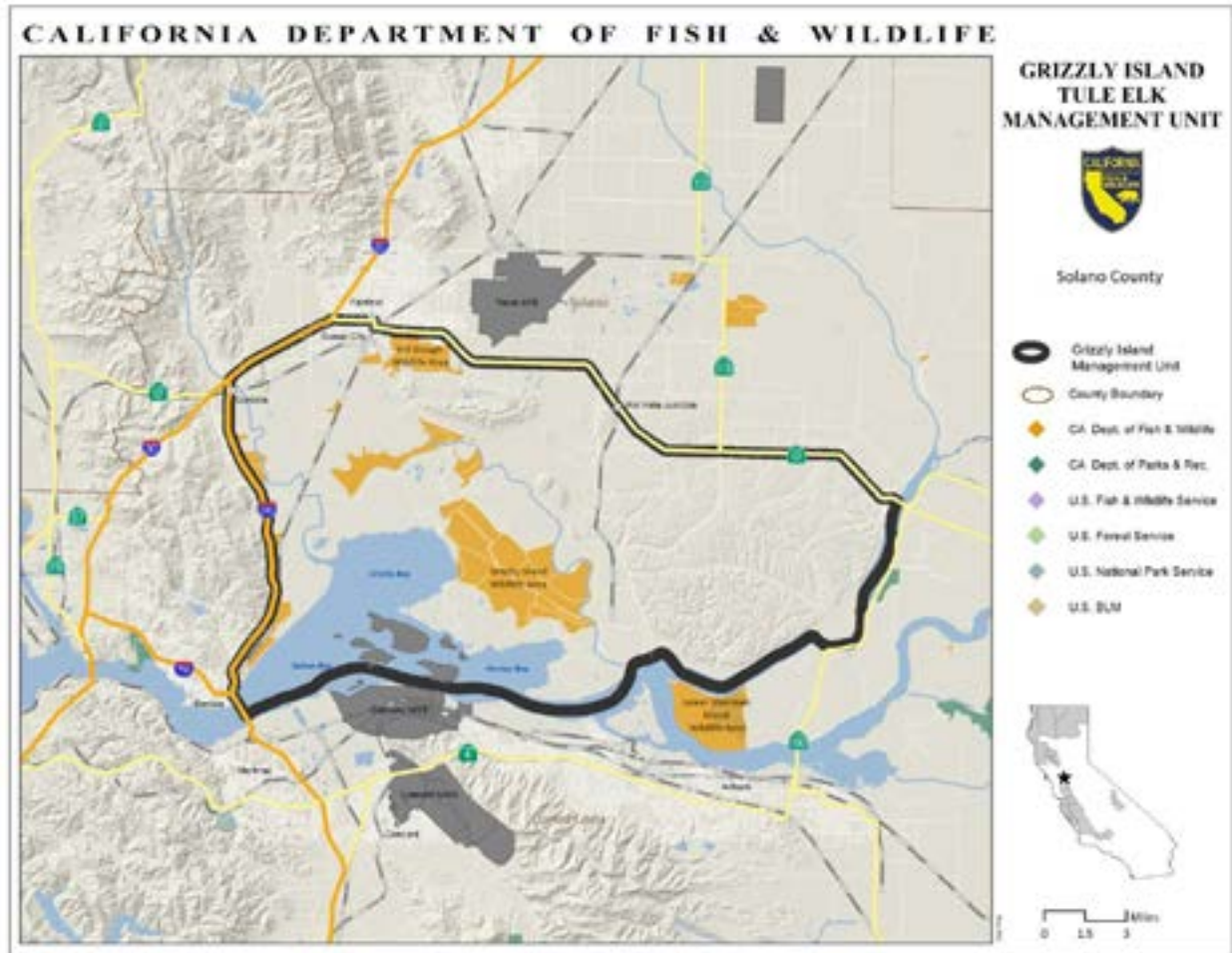


■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 1. Average Age of Elk Taken by Hunting within the East Park Tule Elk Management Unit 2004-2016. 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 (*Distichlis 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; and 2) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 the public to use and enjoy elk (e.g. 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 (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 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. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, 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.

California Department of Fish and Game. 1992. Grizzly Island 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.

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

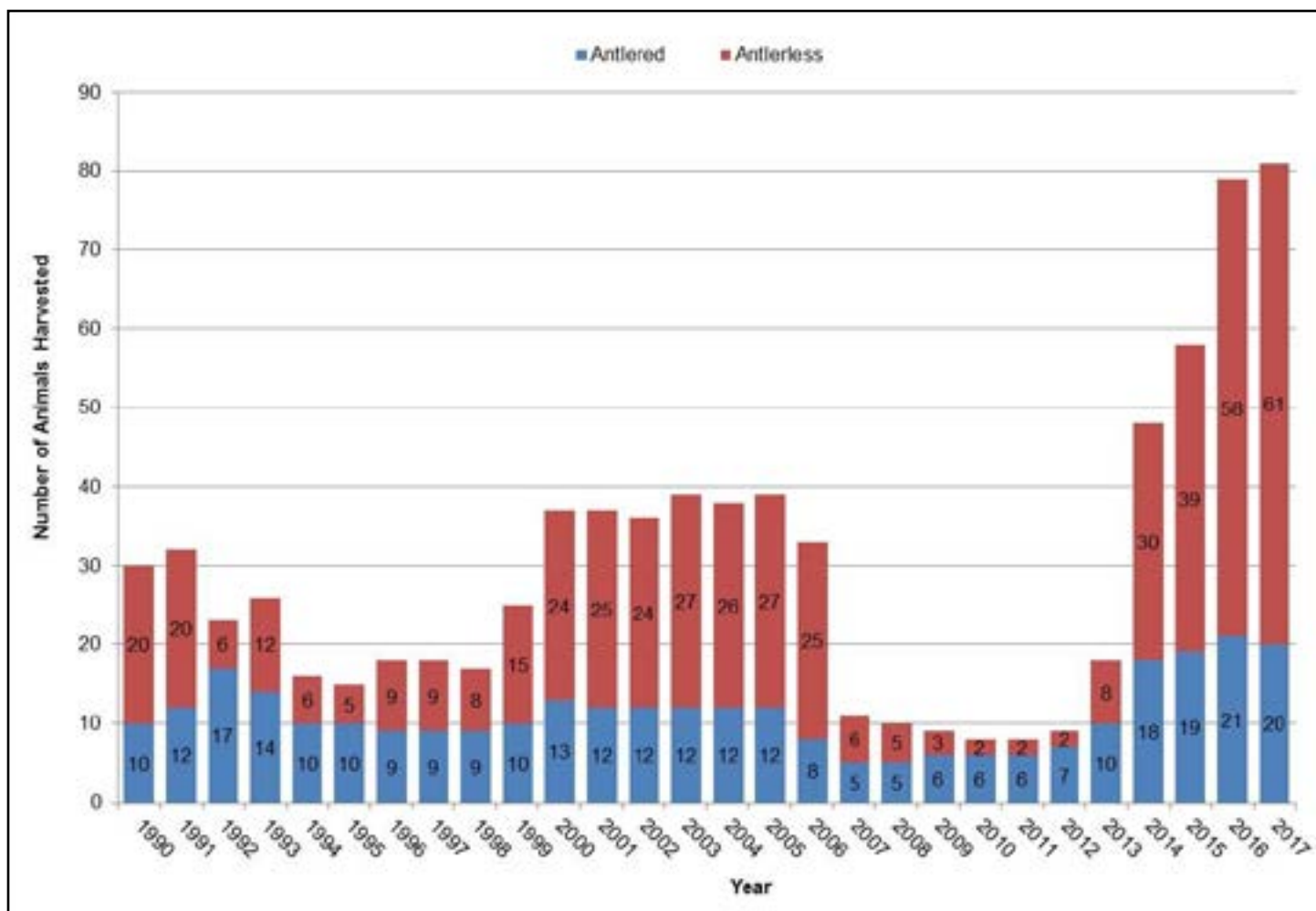
* Based on observation

** 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, 1990-2017.

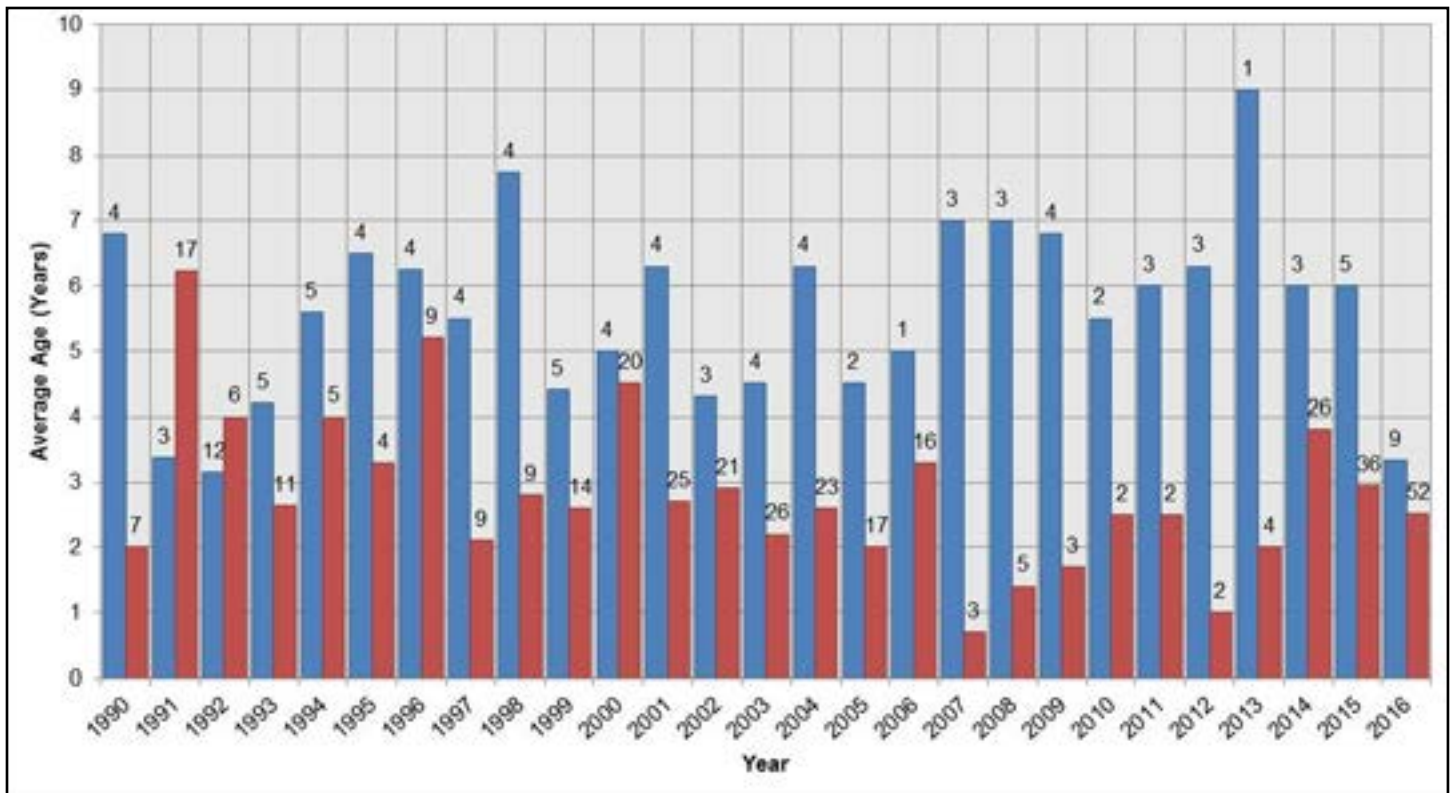
Year	Bull		Antlerless		Four Point or Less Bull		Spike Bull		Apprentice Spike Bull		Apprentice Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest
1990	10	10	20	20								
1991	4	4	20	20	9	8						
1992	11	11	6	6	6	6						
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
2017	6	5	58	55			11	11	4	4	6	6
Totals	131	129	508	487	15	14	155	148	23	23	17	17
Success Rate	98%		96%		96%						100%	



■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 1. Tule Elk Harvest within the Grizzly Island Management Unit, 1990-2017. Sample sizes are denoted above bars for each year.



■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 2. Average Age of Harvested Elk within the Grizzly Island Management Unit, 1990-2016.
 Sample sizes are denoted above bars for each year.

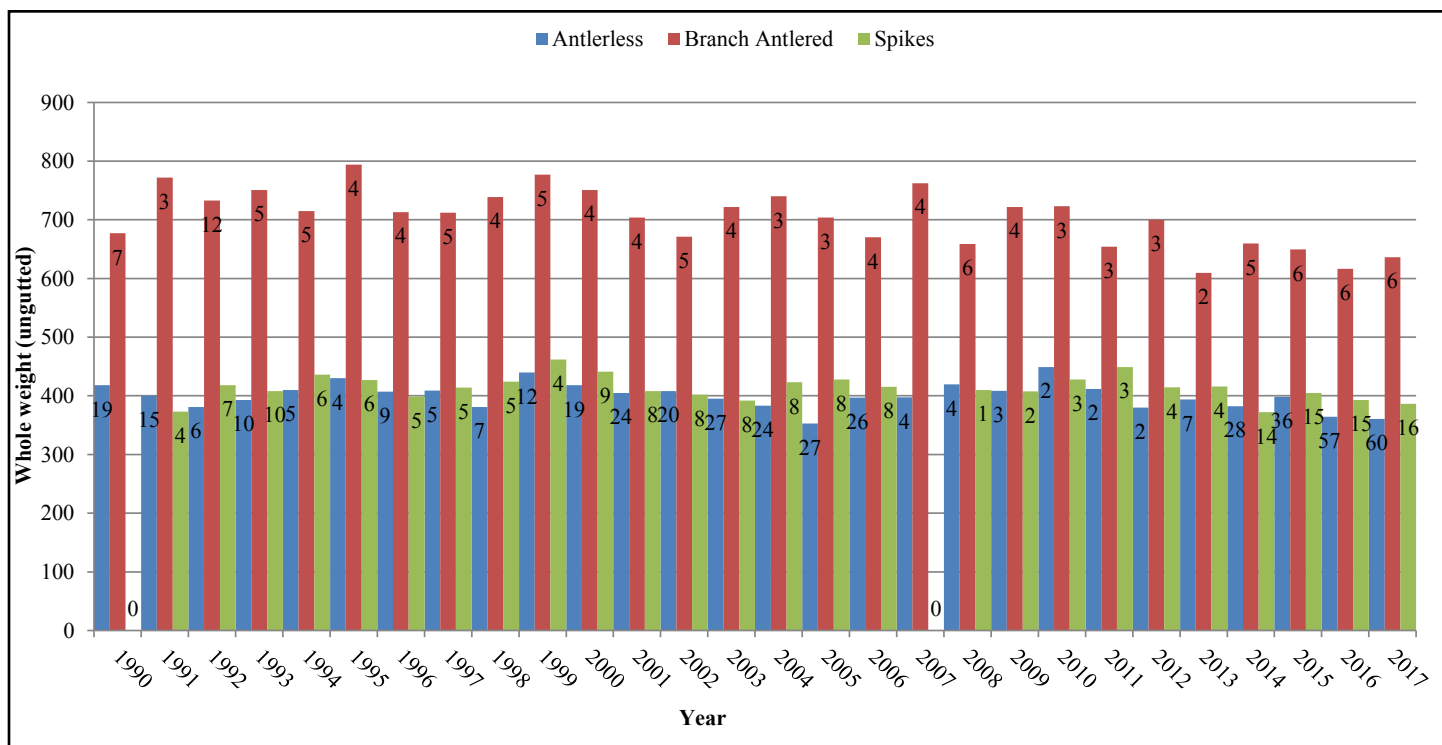
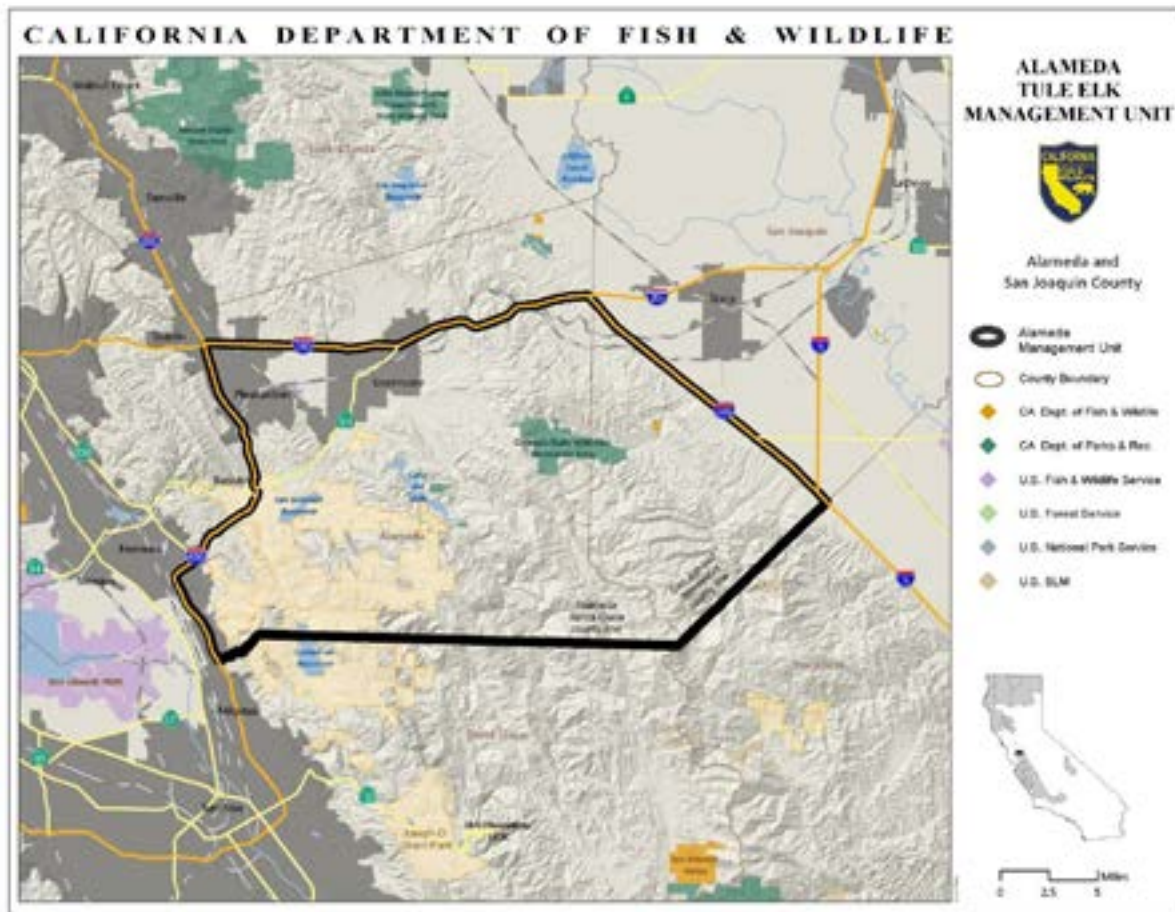


Figure 3. Average Weight (in pounds) of Hunter Harvested Tule Elk within the Grizzly Island Management Unit, 1990 - 2017. Sample sizes are denoted above bars for each year.

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, 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 and the 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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.**

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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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the public to use and enjoy elk (e.g. 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 generally reside on private land not open to hunting and 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.

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

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 (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 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

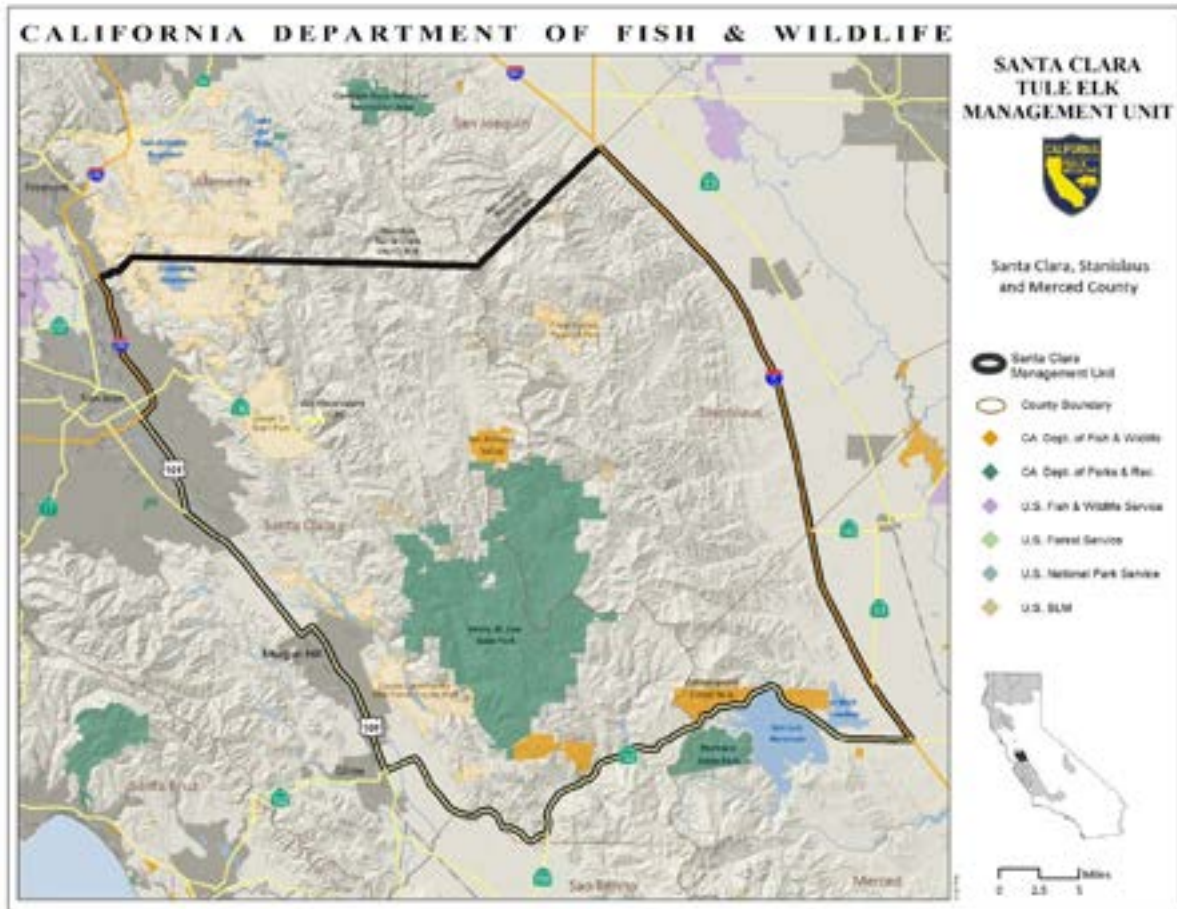
Table 2. Helicopter Survey Results for Alameda and San Joaquin Counties.

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 (1998-2017), 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
2017					2	0	1
Totals	1	0			52	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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the public to use and enjoy elk (e.g. 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 (Commission) 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 Commission 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. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, 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.

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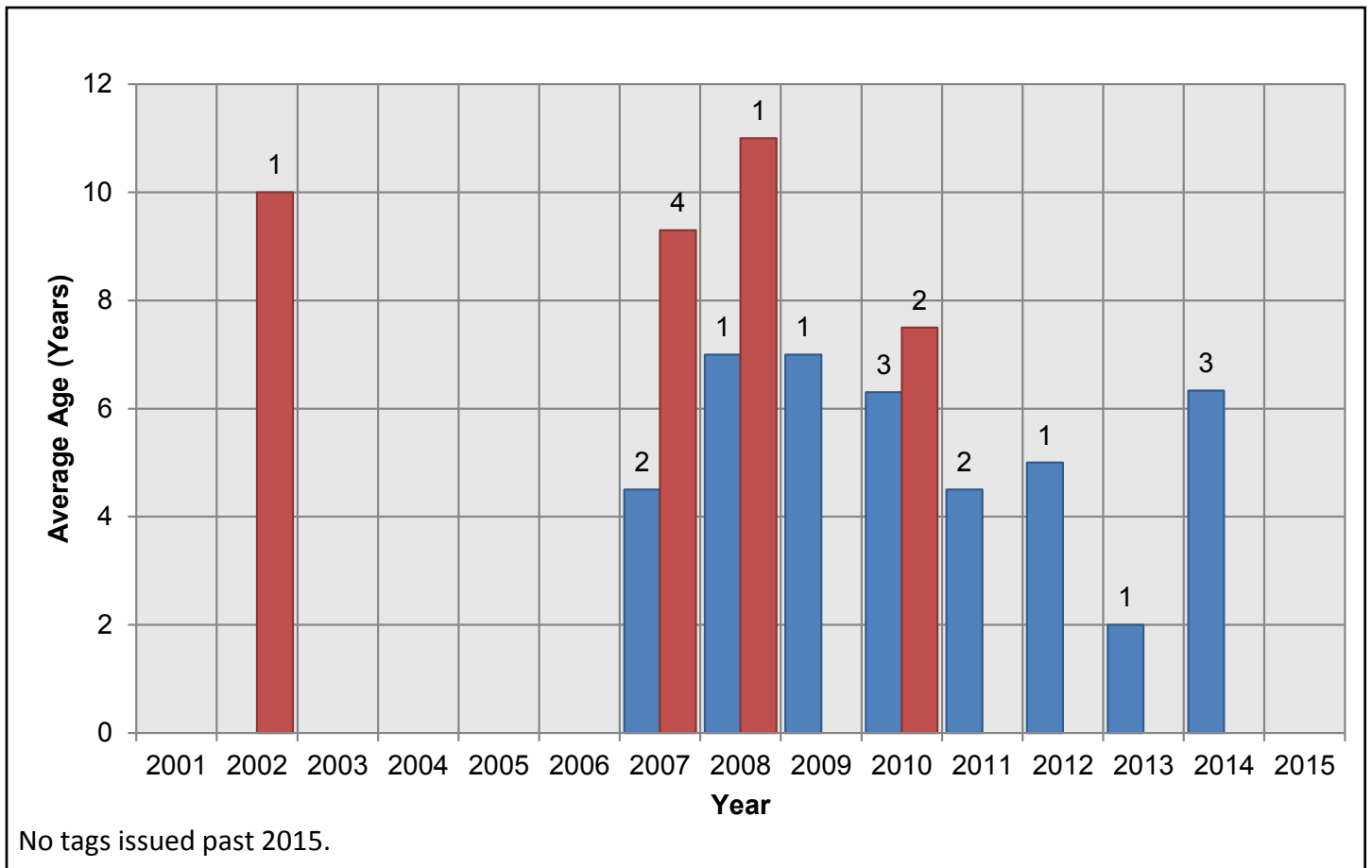
Data Tables/Figures

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, 2010-2017.

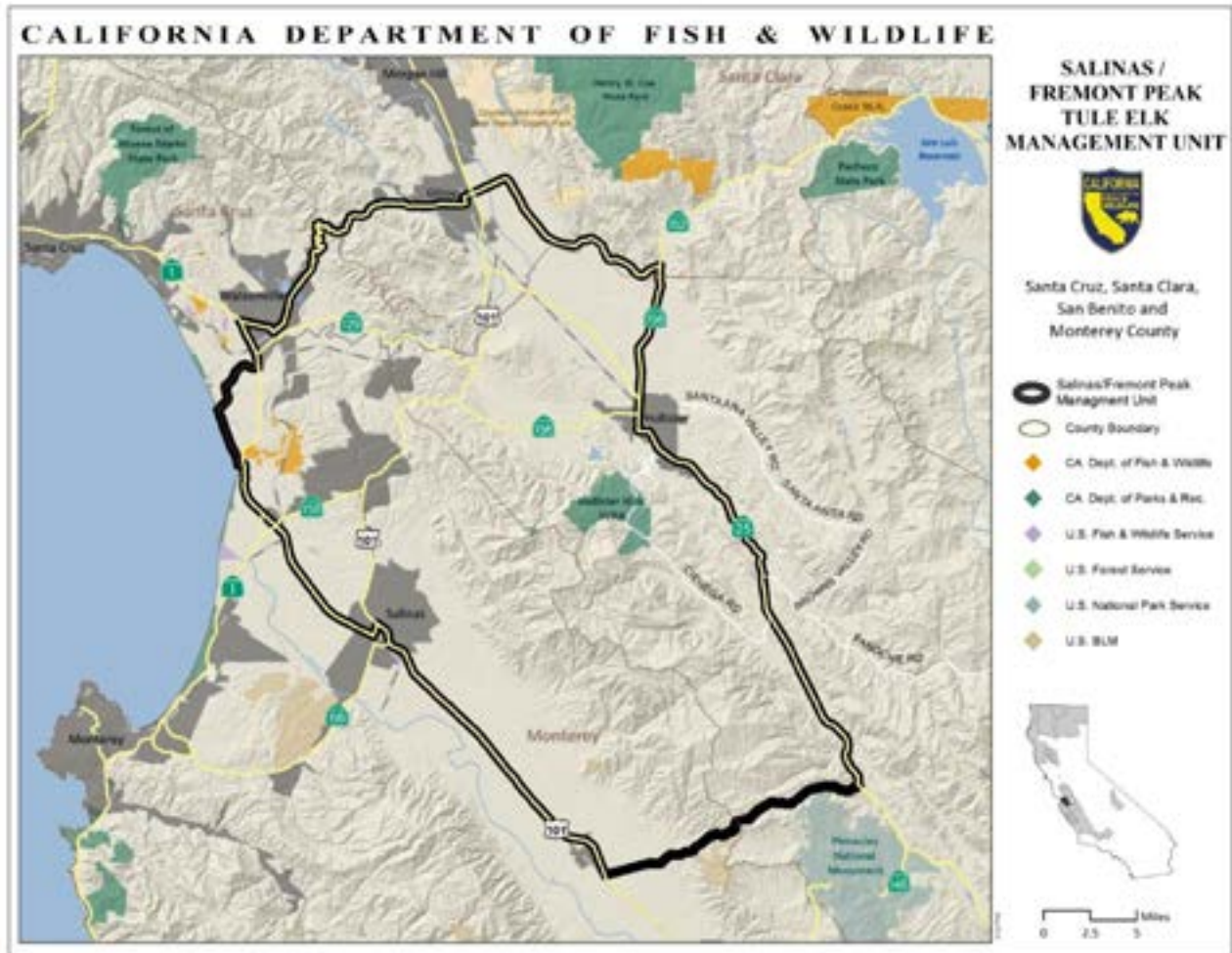
Year	Public Bull		Public Antlerless		Reported PLM Harvest		
	Tags Issued	Harvest	Tags Issued	Harvest	Bull Harvest	Antlerless Harvest	Number of Ranches
2001					3	6	1
2002					3	6	1
2003					3	6	1
2004					5	7	2
2005					6	9	1
2006					7	9	3
2007					9	11	5
2008					5	4	5
2009					6	6	5
2010	1	1			7	5	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
2017					0	0	0
Totals	5	5	0	0	74	77	
Success Rate	100%						



■ Bull
 ■ Antlerless

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 California State Route 25 and 156, and on the west by U.S. State Route 101 and California State Route 183. 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. 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

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within the Unit. Although these factors are unquantified, they have not prohibited 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the public to use and enjoy elk (e.g. 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 incidents 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

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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. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, 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.

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

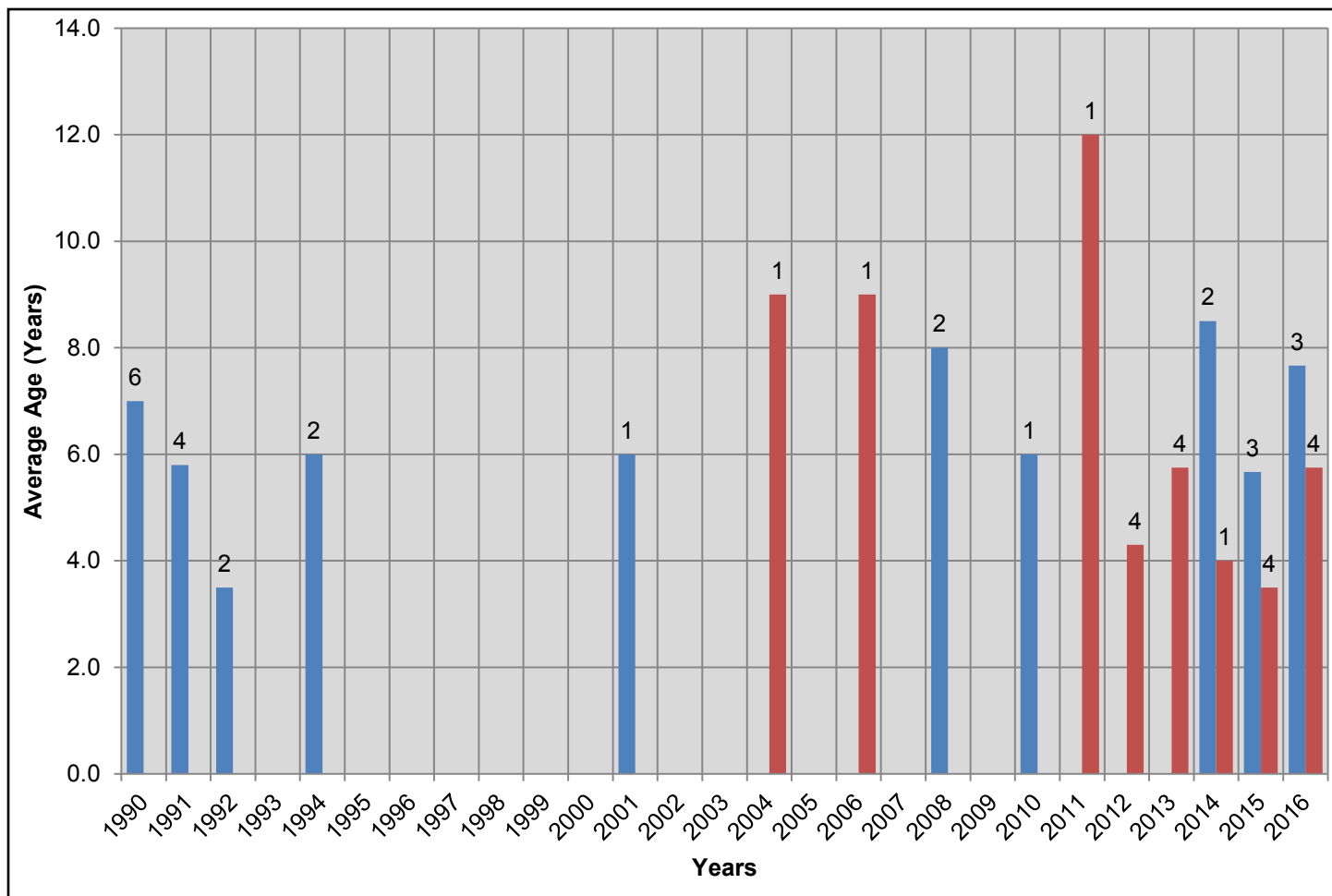
Data Tables/Figures

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, 1990-2017.

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
2017	3	4	3
Totals	78	58	

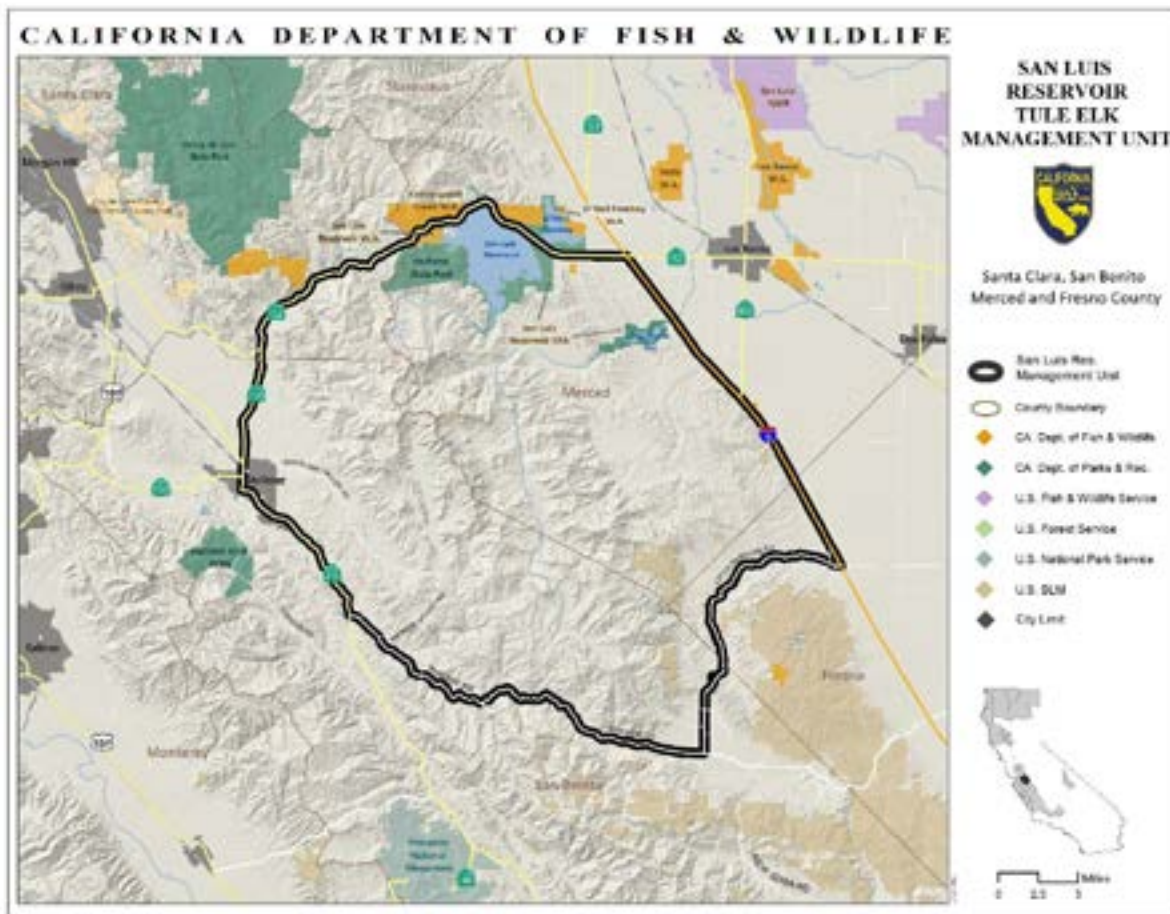


■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 1. Average Age of Harvested Elk within the Salinas/Fremont Peak Tule Elk Management Unit, 1990-2016. 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 to 15 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, assist with evaluating harvest strategies, and prioritize private land conservation values. **Expected completion: 2023.**

Action 1.1.3

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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 1.7.2

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

Goal 2. Enhance opportunities for the public to use and enjoy elk (e.g. 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 incidents 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 ages 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

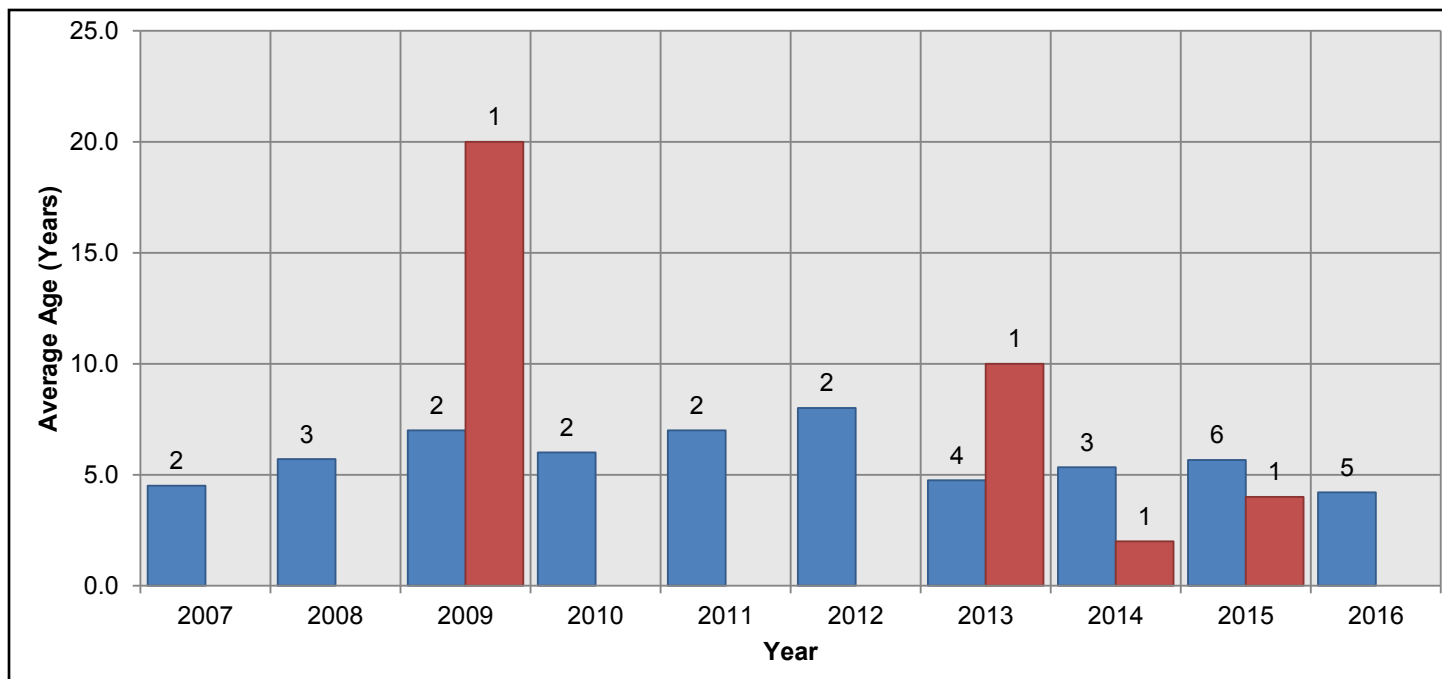
Table 1. A Summary of Population Surveys within the San Luis Reservoir Tule Elk Management Unit, 2001-2016.

Date	Number of Elk Counted				Total
Month, Year	Bulls	Cows	Calves	Unknown	
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, 2007-2017.

Year	Public Either-Sex			Cooperative Either-Sex			Reported PLM Harvest		
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	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
2017	5	3		1	1		2	1	1
Totals	38	34	1	1	1	0	18	6	
Success Rate	89%			100%					



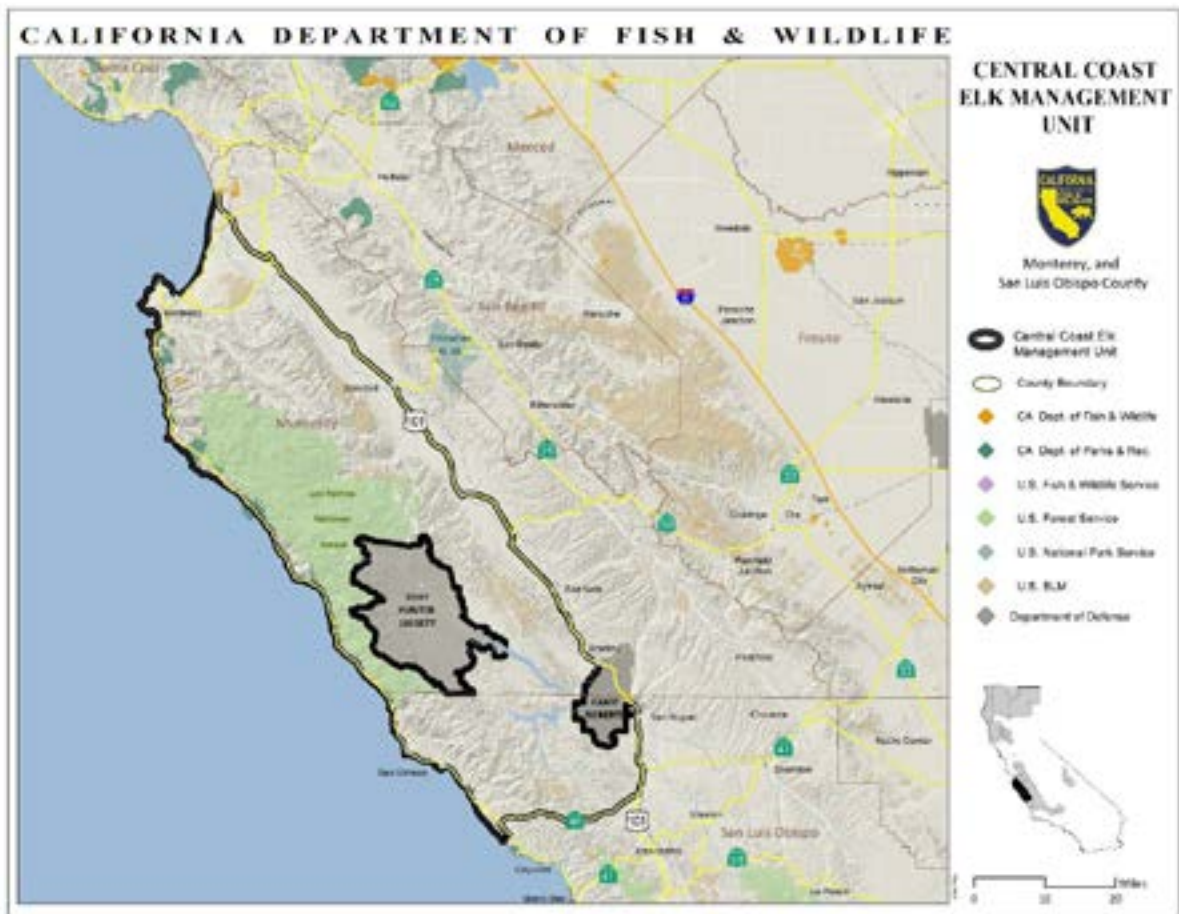
■ Bull

■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 1. Average Age of Harvested Elk within the San Luis Reservoir Tule Elk Management Unit, 2007 - 2016. 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 on the east, Highway 46 on the south, and the Pacific Ocean 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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, Fort Hunter Liggett, Camp Roberts, 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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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.

Objective 4.1. Reduce incidents 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 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

E-240

recommendations. California Department of Fish and Game. Interagency Agreement.
#C-698. Sacramento, 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.

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

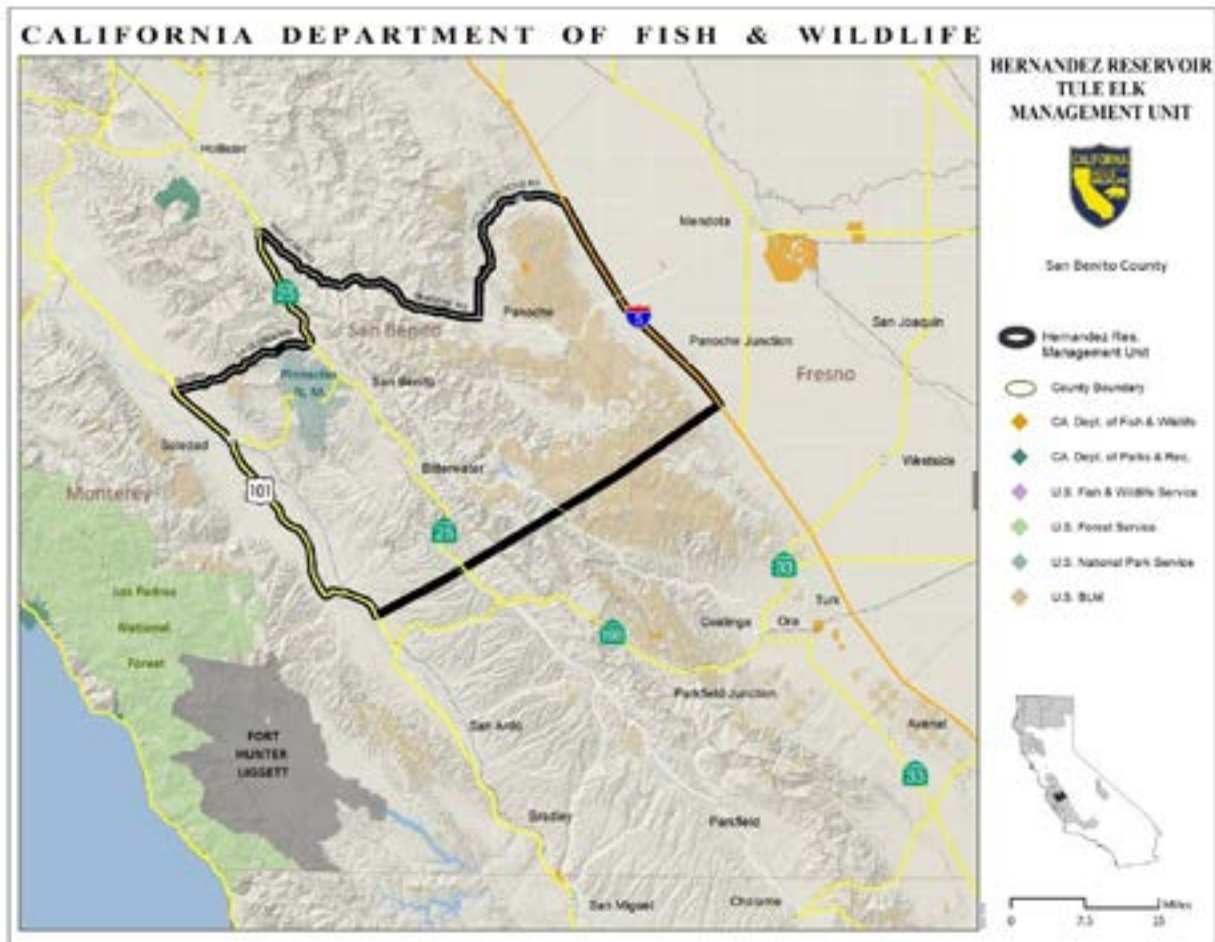
Table 1. Central Coast Tule Elk Management Unit Private Lands Management Area Elk Surveys, 2012-2016.

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), 2012-2017.

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
2017	7	6	7	1	3
Totals	28	24	23	6	

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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the public to use and enjoy elk (e.g. 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 incidents of human-elk conflicts on private property by at least 25% by 2023.

Action 3.1.1

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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 Trincherio 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. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, 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.

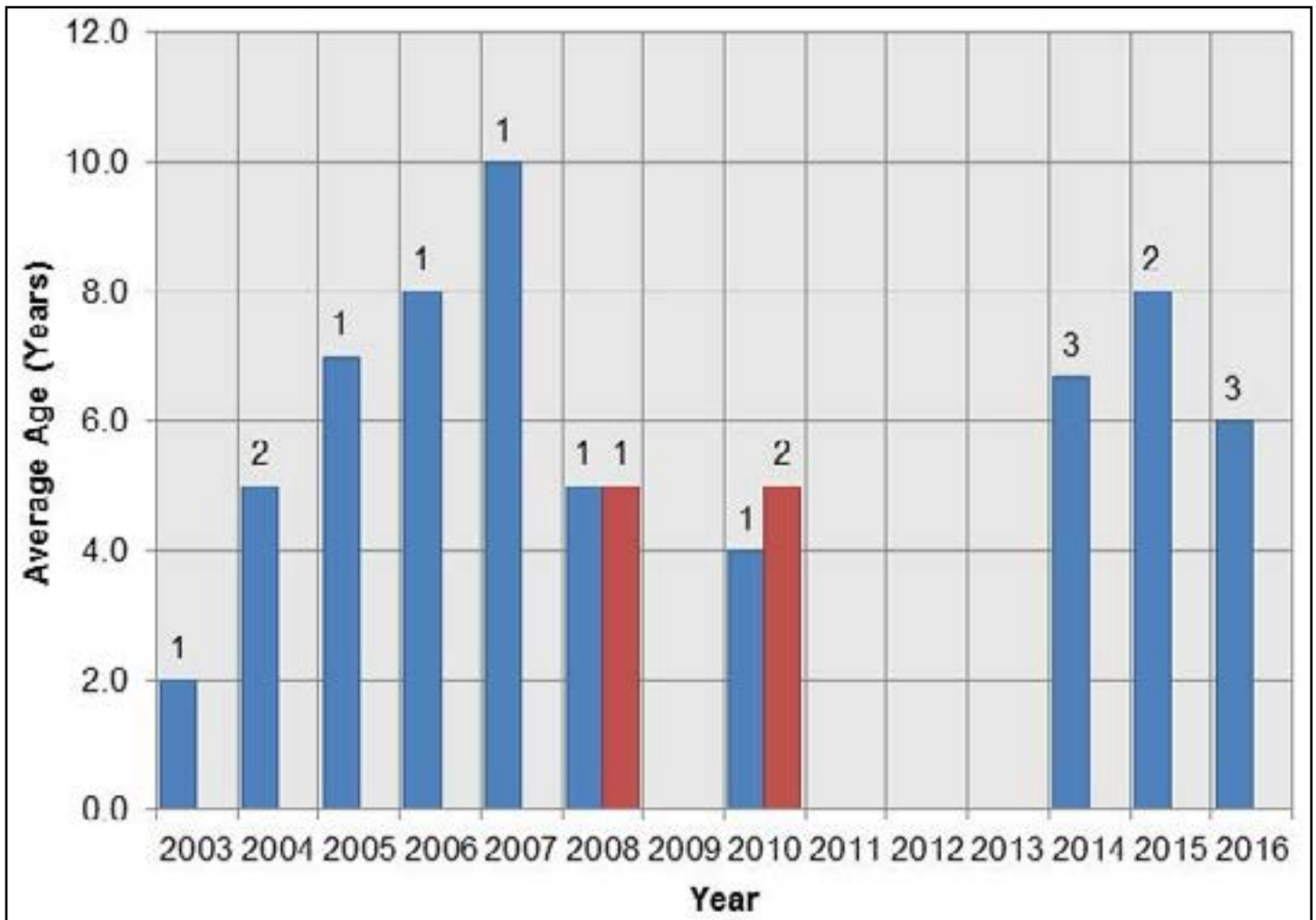
Data Tables/Figures

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,
1997-2017.**

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
2017	6	3	4
Totals	97	29	



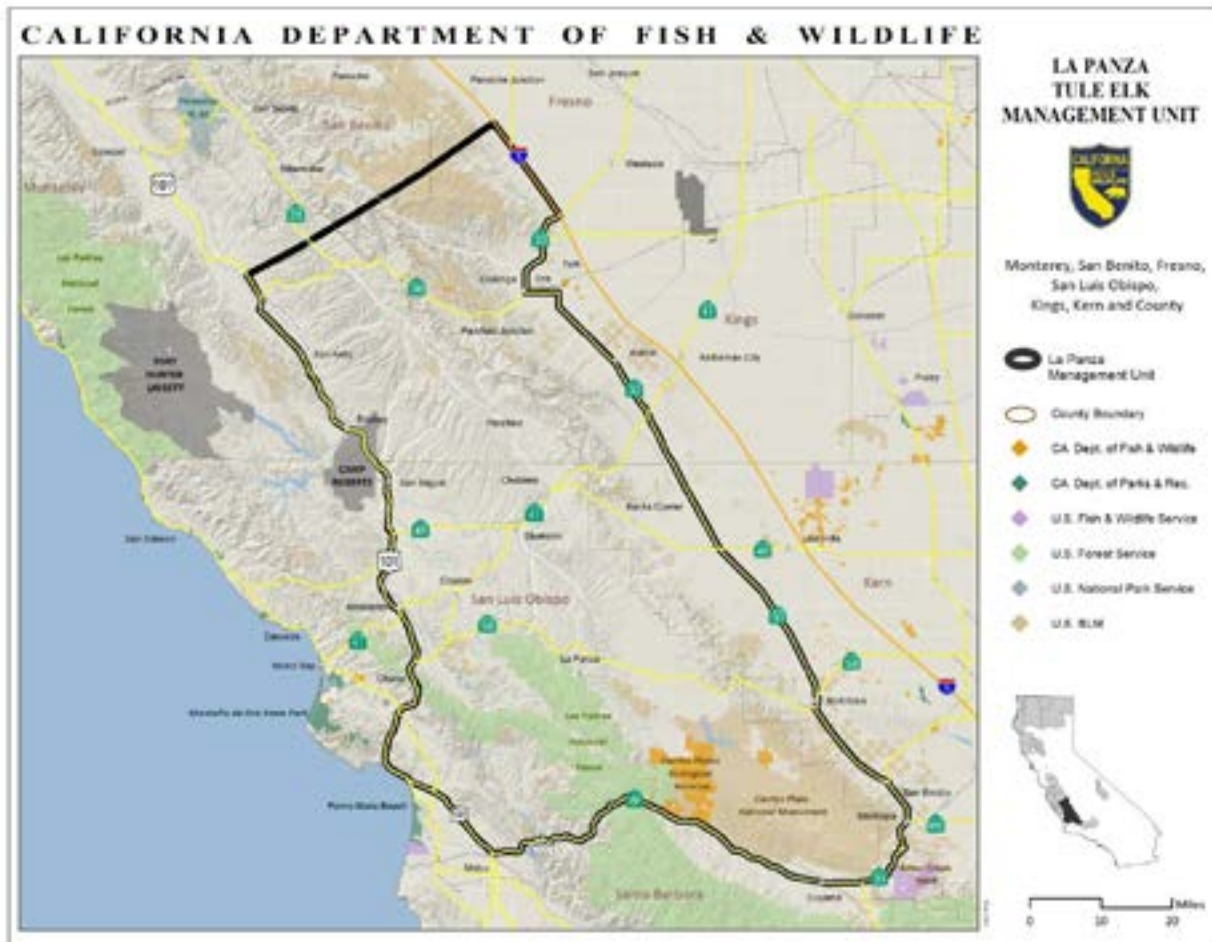
■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting within the Hernandez Reservoir/South San Benito Tule Elk Management Unit, 2003 - 2016.

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 100° F; winter temperatures can decline to 0° 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 one of 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. hunting and wildlife viewing); and 4) alleviate human-elk conflicts and depredation complaints. Specific objectives and actions for each goal are listed below. Department regional and headquarters staff will perform the identified actions.

Goal 1. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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. Collaborate with California Department of Transportation (CalTrans) to provide information and recommendations to reduce vehicle collisions by 2023.

Action 1.5.1

Examine existing elk survey data to assist in determining elk use along roadways. **Expected completion: 2021.**

Action 1.5.2

Provide recommendations to CalTrans for management actions to reduce vehicle collisions along state highways within the unit. **Expected completion: 2023.**

Objective 1.6. Determine genetic diversity of the population 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 500-1,200 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 growth of the elk population and provide landowners with incentives to support having elk on their properties. **Ongoing.**

Action 1.7.2

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 1.7.3

Review data on an annual basis and adjust population objectives as 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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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.

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

Action 3.1.1

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 3.1.2

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

Action 3.1.3

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

Objective 3.2. Work with other agencies and NGOs to install one elk interpretive sign 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 Carrizo Plains Ecological Reserve. **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.

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

Action 4.1.1

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

Action 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 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 Mountain 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 (Commission) 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 Commission 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.

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Unit Highlights

Cooperation and support from private landowners was essential in reestablishing the La Panza herd, one of the largest tule elk herds 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. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, 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. 1988. La Panza 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 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 $\geq$ 350, in '93 FED. Observed Numbers Reconstructed from Composition Ratios.
1994	92	231	69	0	392	H	Reported Pop $\leq$ 600, in '94 FED. Observed Numbers Reconstructed from Composition Ratios.
1995					Almost 500		Reported Pop 600, in '95 FED.
1996							Reported Pop $\geq$ 650, in '96 FED.
1997							Reported Pop $\geq$ 750, in '97 FED.
1998					Almost 500		Reported Pop $\geq$ 750, in '98 FED.
1999	119	232	77	0	428	H	Reported Pop $\geq$ 750, in '99 FED. Observed Numbers Reconstructed from Composition Ratios.
2000	113	424	74	0	611	H, FW	Reported Pop $\geq$ 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, 2012	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, 1993-2017.

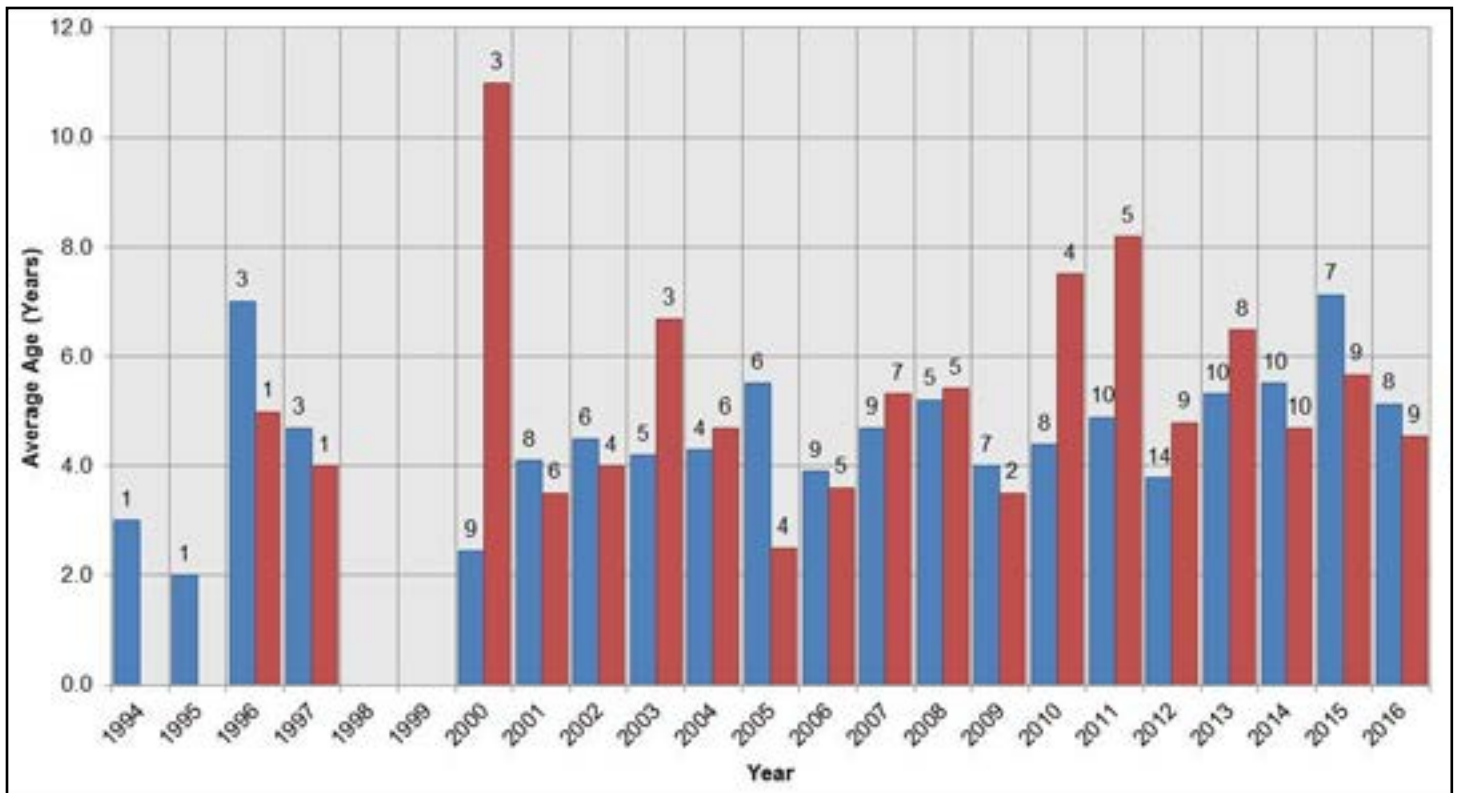
Year	Bull		Antlerless		Apprentice Bull		Apprentice Antlerless		Cooperative Elk Hunting			Reported PLM Harvest		
	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Harvest	Tags Issued	Bull Harvest	Antlerless Harvest	Bull Harvest	Antlerless Harvest	Number of Ranches
1993	6	4	6	1										
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
2017	12	12	11	6			1	1	3	1	0	22	19	9
Totals	291	216	285	144	3	2	9	9	46	19	10	526	508	
Success Rate	74%		51%		67%		100%		63%					

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.

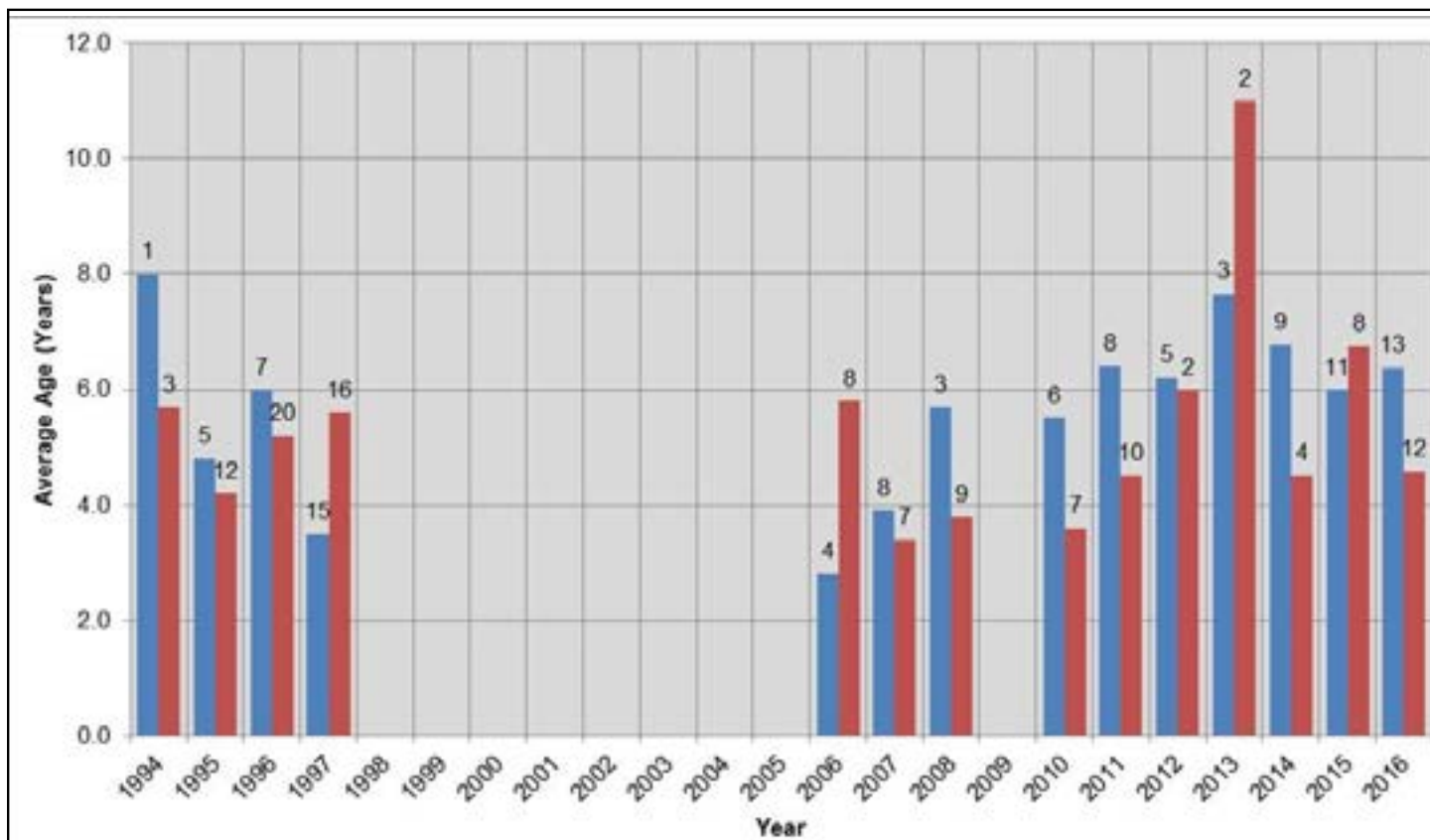
Date	Event	Reference
July 1990	15 cows, 1 sub-adult cow, 3 adult bulls, 1 sub-adult bull relocated to Varian Ranch (Parkfield) from Concord.	CDFW database
August 1990	3 adult bulls relocated to Varian Ranch from Concord.	CDFW database
Oct. 1990	2 cows, 3 sub-adult cows, 6 sub-adult bulls relocated to 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



■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 1. Average Age of Antlered and Antlerless Elk Taken by Public Hunting within the La Panza Tule Elk Management Unit, 1994 - 2016. Sample sizes are denoted above bars for each year.



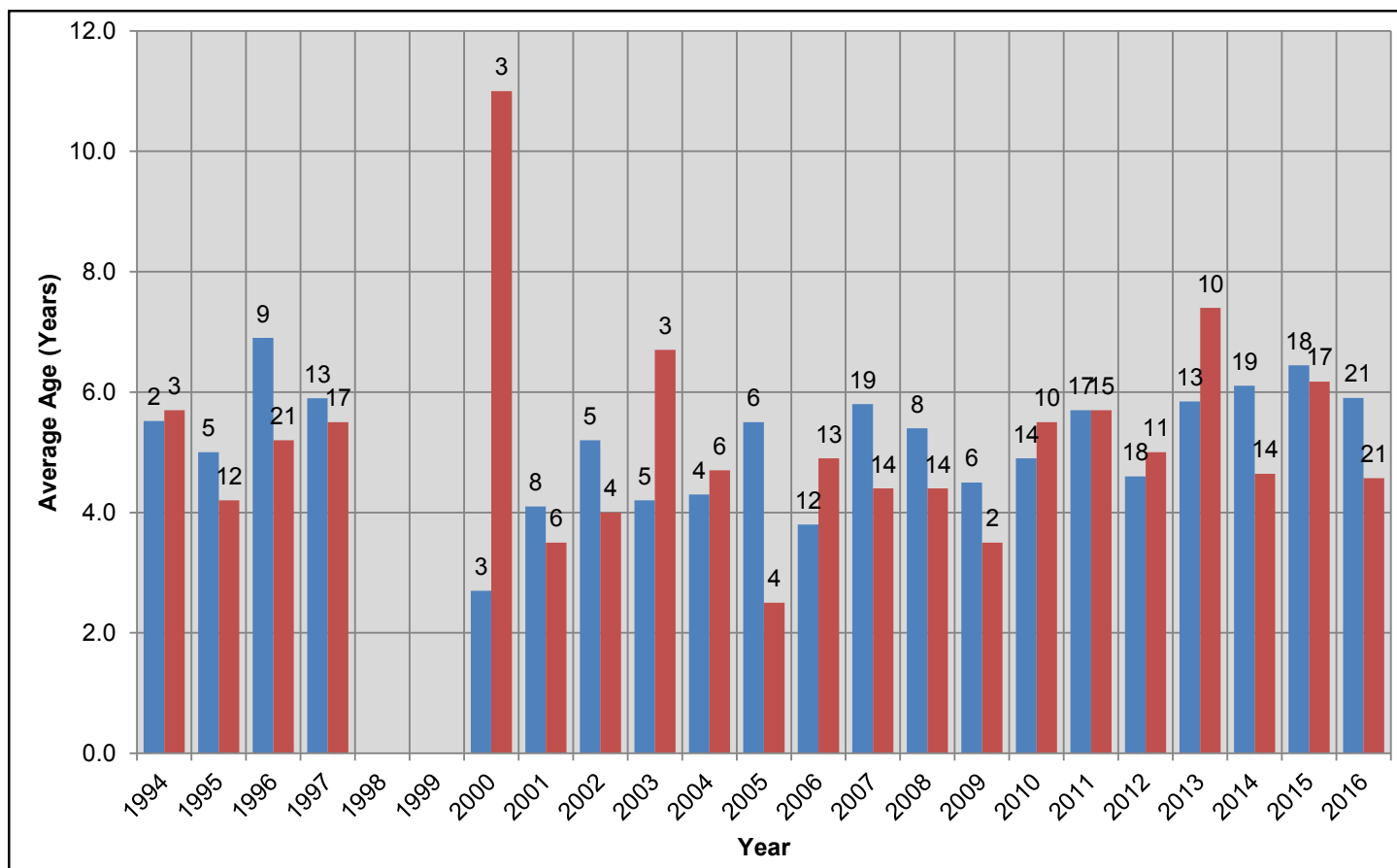
■ Bull

■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

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 - 2016.

Sample sizes are denoted above bars for each year.



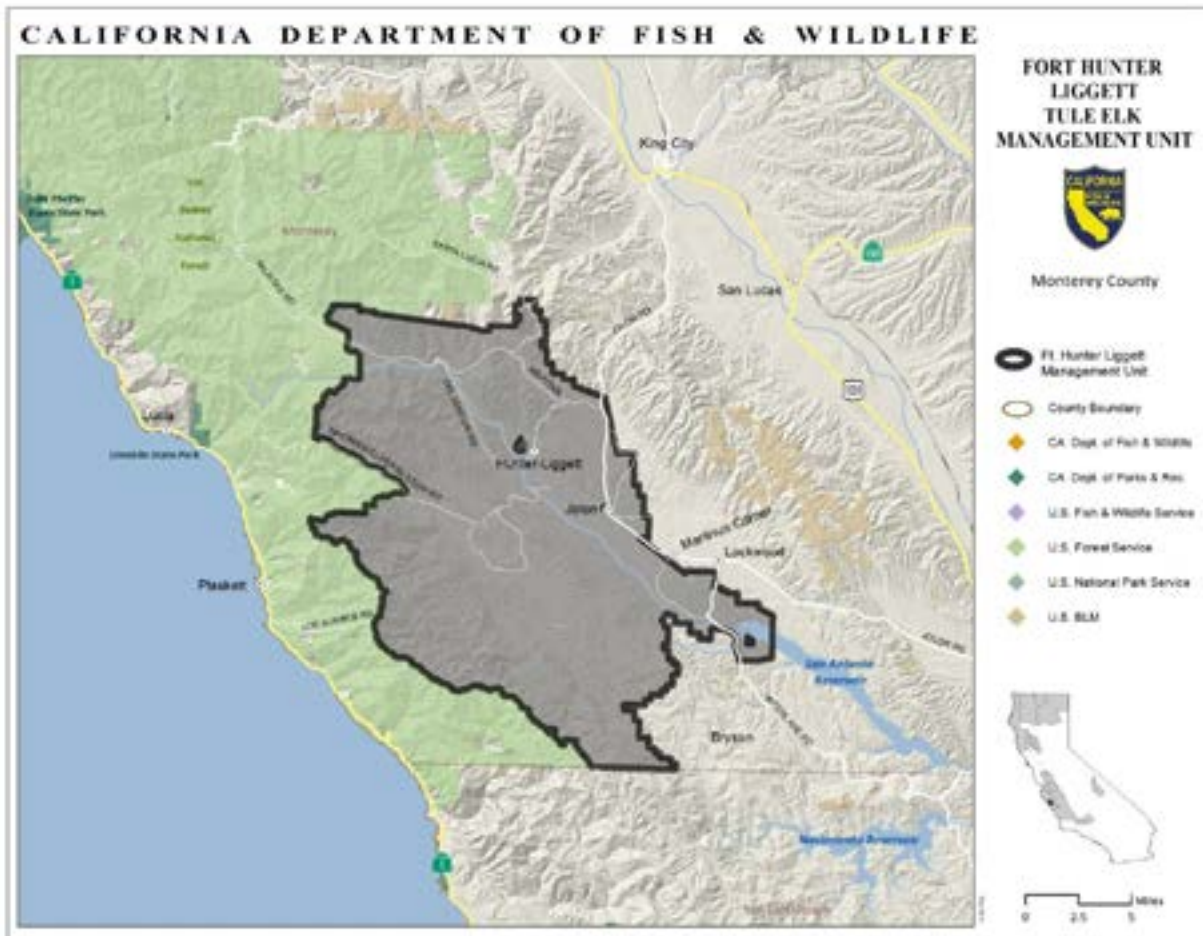
■ Bull
■ Antlerless

Average age depicted if N>1, and individual age if N=1.

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 – 2016.

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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. hunting and wildlife 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the public to use and enjoy elk (e.g. 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. 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 incidents 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. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, 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, 1996-2017.

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***															
2017					6	6						8	3	8	7
Totals	256	192	487	282	74	55	1	116	27	19	17	40	25	32	22
Success Rate	75%		58%		76%			23%		89%		63%		69%	

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 Liggett due to increased military training.

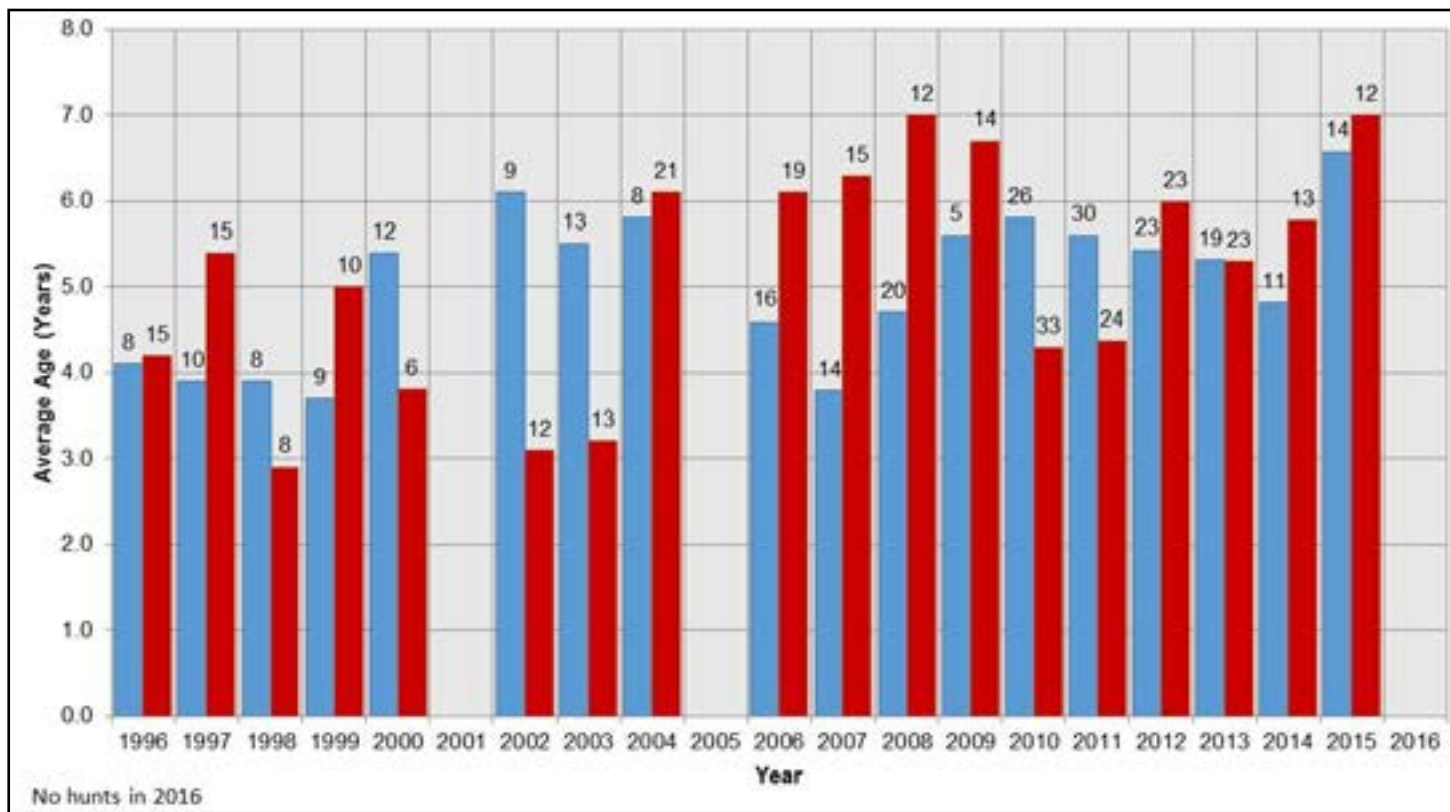
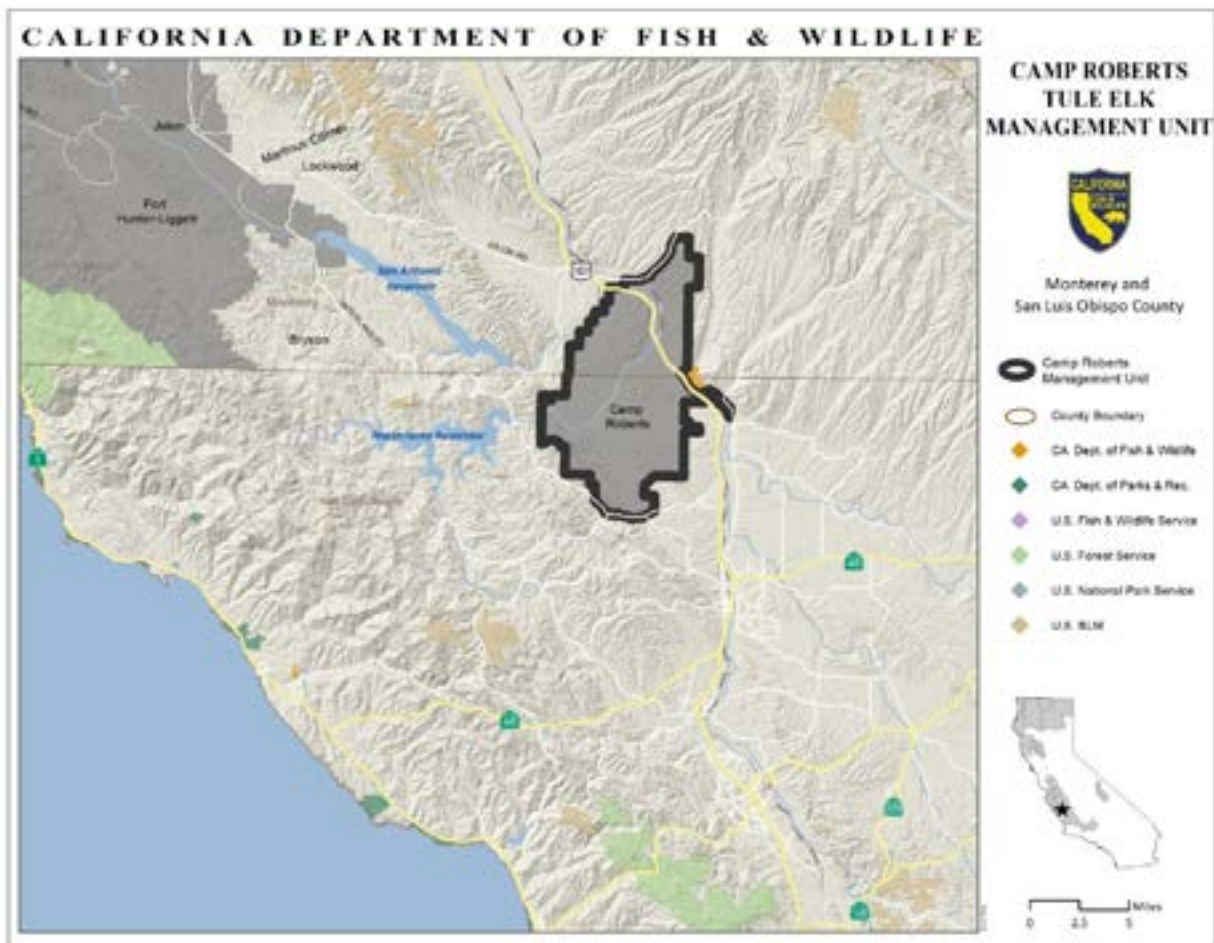


Figure 1. Average Age of Antlered and Antlerless Elk Taken by Hunting within the Fort Hunter Liggett Tule Elk Management Unit, 1996-2016. Sample sizes are denoted above bars for each year.

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

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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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. hunting and wildlife viewing); 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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. Enhance opportunities for the public to use and enjoy elk (e.g. 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 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 incidents 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 Nacimiento 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. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, 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.

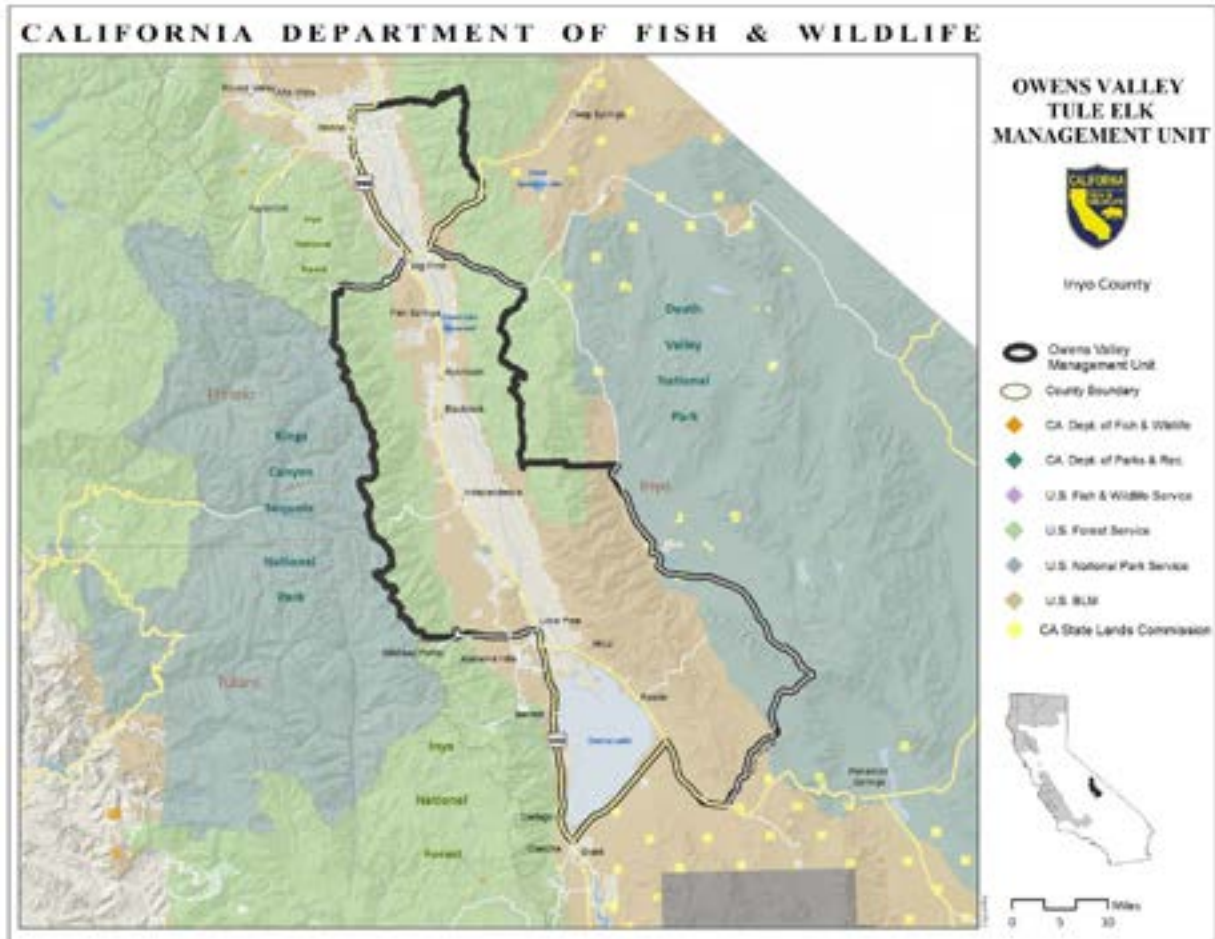
Date	Number of Elk Counted					Notes
Month, Year	Bulls	Cows	Calves	Unknown	Total	
Dec. 1978	6	11	4		21	Source: The Tule Elk in California, Vol 3
Jan. 1979	5	11	3		19	Source: The Tule Elk in California, Vol 3
Jan. 1980	2	8	4		14	Source: The Tule Elk in California, Vol 4
Dec. 1980	2	11	4		17	Source: The 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 conducted 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 100° F; winter lows can reach 0° 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 shadscale (*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 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 (Commission) 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 in the Owens Valley established a maximum level of 490, or any greater number hereafter determined by the Department to be the holding capacity in accordance with game management principles. A 1976 federal law concurred with the state legislation. From 1971-1988, the Department translocated 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 the Owens Valley, 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). A sightability model was developed expressly for the Owens Valley (Bleich et al. 2001). The model provides a method by which fixed-wing surveys of the various elk subpopulations can be corrected for sightability and a means of placing confidence intervals around the estimates. 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 population 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 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 jurisdictional boundaries; 3) enhance opportunities for the public to use and enjoy elk (e.g. 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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

The elk population is stable and below the population objective identified in Objective 1.5 of 350-450 elk. An increase in the population is needed to bring the levels to within population objectives. The Owens Valley herd is unique in that the current maximum population level is set in Section 3951 of the California Fish and Game Code (FGC §3951) at 490 animals. The upper end population objective of 450 is below this maximum to prevent the population from exceeding the maximum objective. Utilizing regulated harvest, the Department will maintain the elk population between 350-450 individuals. 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.

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

Implement annual aerial surveys using survey methodology developed by Bleich et al. (2001) (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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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

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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, NPS, 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. Collaborate with California Department of Transportation (CalTrans) to provide information and recommendations to reduce vehicle collisions by 2023.

Action 1.4.1

Examine existing elk survey data to assist in determining elk use along roadways. **Expected completion: 2021.**

Action 1.4.2

Provide recommendations to CalTrans for management actions to reduce vehicle collisions along state highways within the unit. **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 jurisdictional boundaries.

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 the public to use and enjoy elk (e.g. 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. **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 incidents 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.

Male tule elk are susceptible to high rates of antler breakage in the Owens Valley that may be linked to a mineral deficiency in their diet (Johnson et al. 2005, Johnson et al. 2007a, Johnson et al. 2007b). Although the elk population has been regulated through harvest and is viable, antler abnormalities have been documented for many years. These studies indicate that habitat conditions may not be meeting all nutritional requirements (Johnson et al. 2007a). If a mineral deficiency is inhibiting antler development, other physiological processes may be affected, such as reproduction (Johnson et al. 2007a).

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 Commission authorized public elk hunting for the Bishop and Lone Pine zones (Tables 8 and 9). However, the 1989 harvest overwhelmingly

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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 Commission 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 Commission 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 Commission 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 Commission 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 Commission 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 Commission 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.

- In 2001, a sightability model using telemetered animals was developed expressly for the Owens Valley (Bleich et al. 2001). The model is used to predict the likelihood of observing a group of elk.
- 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, that resulted in moving the early season elk hunt dates to precede antler breakage.
- 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,

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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

Berbach, M.W. 1991. Activity patterns and range relationships of tule elk and mule deer in Owens Valley. Unpublished Dissertation, University of California, Berkeley, USA.

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California Department of Fish and Game. 1988. Owens Valley tule elk management unit management plan. Unpublished report, California Department of Fish and Game, Sacramento, USA.

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US Forest Service. 1965. Tule elk habitat management plan, Inyo National Forest. US Forest Service, Inyo National Forest, Bishop, California, USA.

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Johnson, H.E., V.C. Bleich, P.R. Krausman, and J.L. Koprowski. 2007b. Effects of antler breakage on mating behavior in male tule elk (*Cervus elaphus nannodes*). *European Journal of Wildlife Research* 53:9-15.

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. 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, G denotes ground, FW denotes fixed wing).

Year	Number of Elk Counted					Removed		Comments/Survey Method
	Bulls	Cows	Calves	Unknown	Total	Hunting	Relocated	
1933	7	11	6	3	27			27 elk relocated to OV from Yosemite.
1934	10	30	12	3	55			28 additional elk to OV from Tupman Reserve.
1943	60	97	32		189	43		FW
1944	9	94	26		129			FW
1945	34	202	32		268			FW
1946	37	221	47		305			FW
1947	38	174	53		265			FW
1948	68	191	61		320			FW
1949	73	350	72		495	107		FW
1950				153	153			FW
1951				199	199			FW
1952	40	92	28	62	222			FW
1953	60	156	40		256			FW
1954	33	117	42		192			FW
1955	36	224	43		303	144		FW
1956	46	108			154			FW
1957	33	141			174			FW
1958	63	162			225			Jan, FW
1958	59	109		84	252			Dec, FW
1960	59	222		4	285			March, FW
1960	35	166	42		243			June, FW
1960	82	245			327			Dec, FW
1961	94	156	45	1	296	40		June, FW
1961	89	224			313			Dec, FW
1962	91		11		102	59		June, FW
1962	90	154			244			Dec, FW
1963	45	102	30		177			July, FW
1963	89	219			308			Dec, FW
1964	88	157	37		282			FW
1964	85	194			279	50		FW
1965	59	90	31		180			FW
1966	68	172	47	3	290			FW
1967	64	128	54	0	246			FW
1968	93	181	61	0	335			FW
1969	68	209	51	2	330	78		FW
1970	37	150	41	0	228			Aug, FW
1970	59	175	58	0	292			Sept, FW
1971	65	161	65	0	291			FW
1972	52	194	34	0	280			FW
1973	79	195	66	0	340			FW
1974	65	245	65	0	375			FW
1975	96	245	59	0	400			FW
1976	101	300	77	0	478			FW
1977	143	354	85	0	582		48	FW
1978	124	301	89	0	514		79	Aug, FW
1978	138	285	90	0	514			Sept, FW
1979	143	262	82	0	487			FW
1980	132	302	99	0	533		102	FW
1981	121	263	92	0	476		33	FW
1982	117	247	82	0	446			FW

Table 1. Owens Valley Tule Elk Management Unit, Population Survey Results and Herd History (Continued).

Year	Number of Elk Counted					Removed		Comments/Survey Method
	Bulls	Cows	Calves	Unknown	Total	Hunting	Relocated	
1983	111	269	115	0	495			FW
1984	151	328	130	0	609			FW
1985	158	365	77	0	600		170	FW
1986	105	242	82	0	429			FW
1986	155	264	100	0	519			H
1987	129	268	68	0	465			FW
1987	151	302	71	0	524			H, Tinehama and Whitney FW
1988	123	235	67	0	425			FW
1988	194	297	72		563			H
1989	104	241	54		399	77		FW
1990	81	237	40		358	36		FW
1991	69	227	45		341	44		FW
1992	67	210	29		306	37		FW
1993	109	230	54		393	22		FW
1994	111	193	45		349	29		FW
1995	91	159	41		291	24		June, FW
1996	95	176	65		336	21		FW/Sightability Model Used
1997	68	149	51		268	19		FW/Sightability Model Used
1998	83	169	46		298	29		FW/Sightability Model Used
1999	65	127	35	70	297	26		FW/Sightability Model Used
2000	86	208	48		342	43		FW/Sightability Model Used
2001	63	181	55		299	26		FW/Sightability Model Used
2002	70	208	30	0	308	22		FW/Sightability Model Used
2003	58	238	56	0	352	19		FW/Sightability Model Used
2004	81	192	57		330	27		FW/Sightability Model Used
2005	74	238	83		395	19		FW/Sightability Model Used
2006	49	362	42		453	19		FW/Sightability Model Used
2007	81	291	33		405	75		FW/Sightability Model Used
2008	58	165	57		280	69		FW/Sightability Model Used
2009	134	188	71		393	55		G/FW
2010	87	178	48		313	66		G/FW
2011	136	176	57		369	60		G/FW
2012	129	109	50		288	58		G/FW
2013	92	79	14		185	52		G/FW
2014	79	76	20		175	26		G/FW
2015	74	96	38		208	22		G/FW
2016	63	121	55		239	11		G/FW
2016	62	79	23		164			H
2017	60	141	54		255	10		G/FW

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, 1989-2017.

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													
2017													
Totals	40	35	2	56	51	102	87	12	11	21	18	23	18
Success Rate	93%			91%		85%		92%		86%		78%	

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Table 9. Lone Pine Tule Elk Hunt, Tag Quotas, and Harvests, 1989-2017.

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								
2017				2	1	2	2					1	0		
Totals	40	38	2	98	91	274	232	3	3	3	3	9	6	9	1
Success Rate	100%			93%		85%		100%		100%		67%		11%	

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Table 10. Independence Tule Elk Hunt, Tag Quotas, and Harvests, 1994-2017.

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		
2017	2	1	3	1			1	0		
Totals	37	35	61	39	3	1	12	10	11	8
Success Rate	95%		64%		33%		83%		73%	

Table 11. Tinemaha Tule Elk Hunt, Tag Quotas, and Harvests, 1998-2017.

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		
2017								
Totals	83	76	248	151	32	16	36	15
Success Rate	92%		61%		50%		42%	

Table 12. Tinemaha Mountain Tule Elk Hunt, Tag Quotas, and Harvests, 2010-2017.

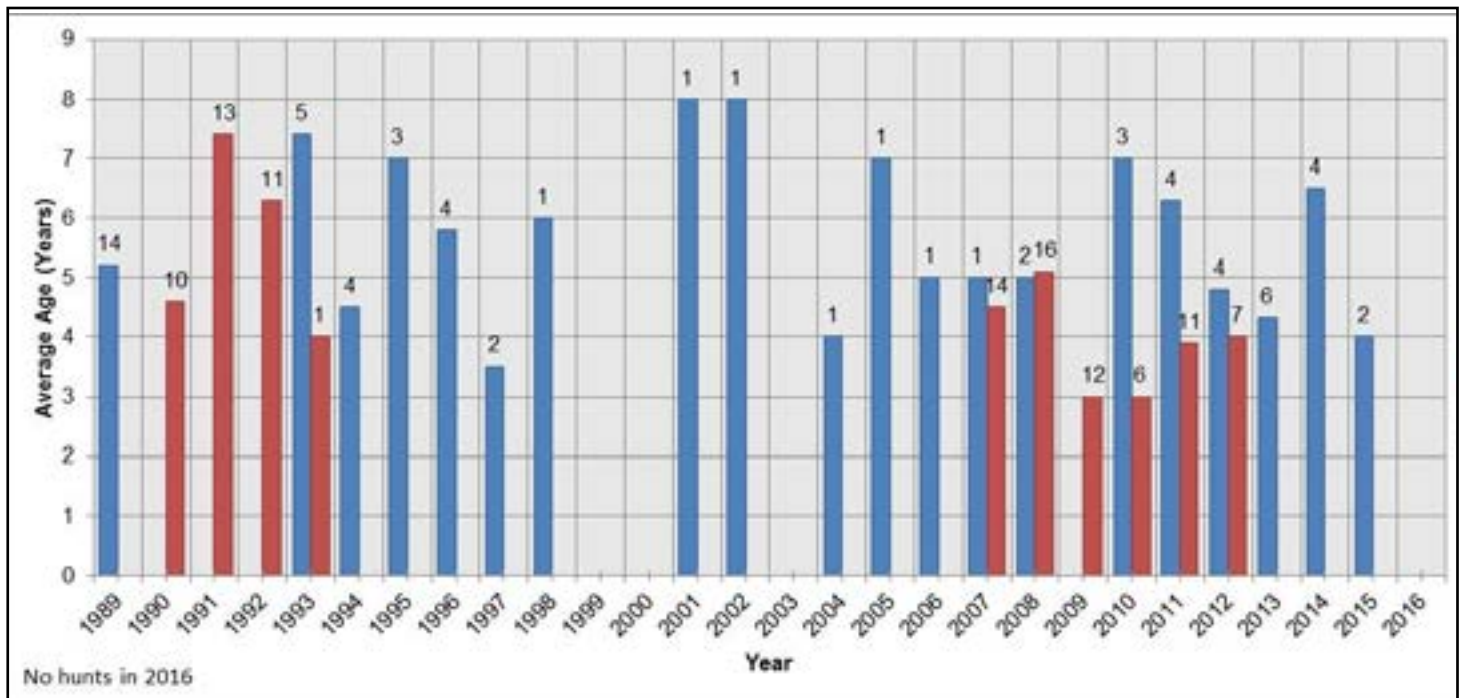
Year	Bull		Antlerless	
	Tags Issued	Harvest	Tags Issued	Harvest
2010	2	2		
2011	2	1		
2012	2	1		
2013	1	0		
2014	1	0		
2015	2	2		
2016	0	0		
2017	0	0		
Totals	10	6	0	0
Success Rate	60%			

Table 13. Whitney Tule Elk Hunt, Tag Quotas, and Harvests, 2010-2017.

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						
2017			1	0		
Totals	10	10	32	22	2	2
Success Rate	100%		69%		100%	

Table 14. Owens Valley Archery Only Tule Elk Hunt, Tag Quotas and Harvests, 2002-2017. Note: Quota/Harvest for 2011 includes one tag issued through cooperative elk hunting.

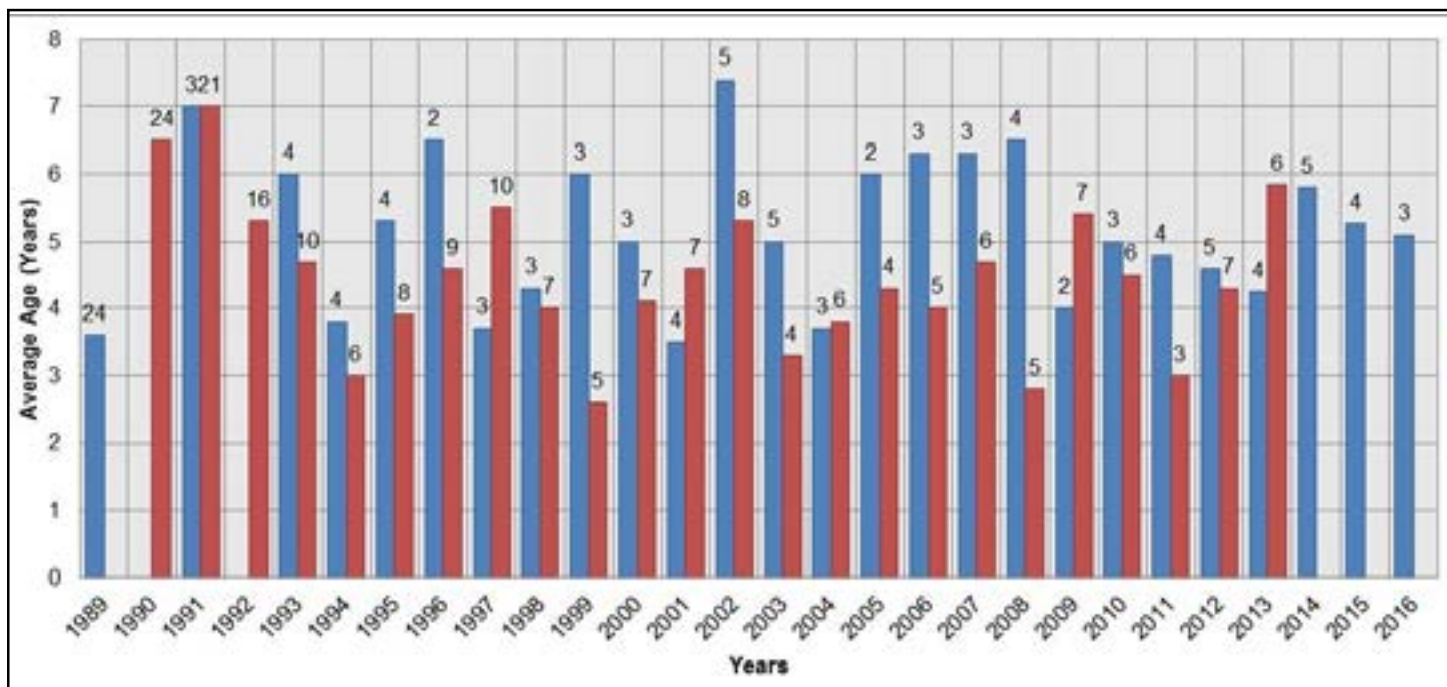
Year	Either-Sex			Bull	
	Tags Issued	Bull Harvest	Antlerless Harvest	Tags Issued	Harvest
2002	5	2	1		
2003	7	5			
2004	7	5			
2005	7	4			
2006	5	2			
2007	5	4			
2008	5	4			
2009	5	2			
2010				5	5
2011				6	6
2012				5	4
2013				5	1
2014				5	3
2015				5	5
2016				3	3
2017				3	1
Totals	46	28	1	37	28
Success Rate	63%			93%	



■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

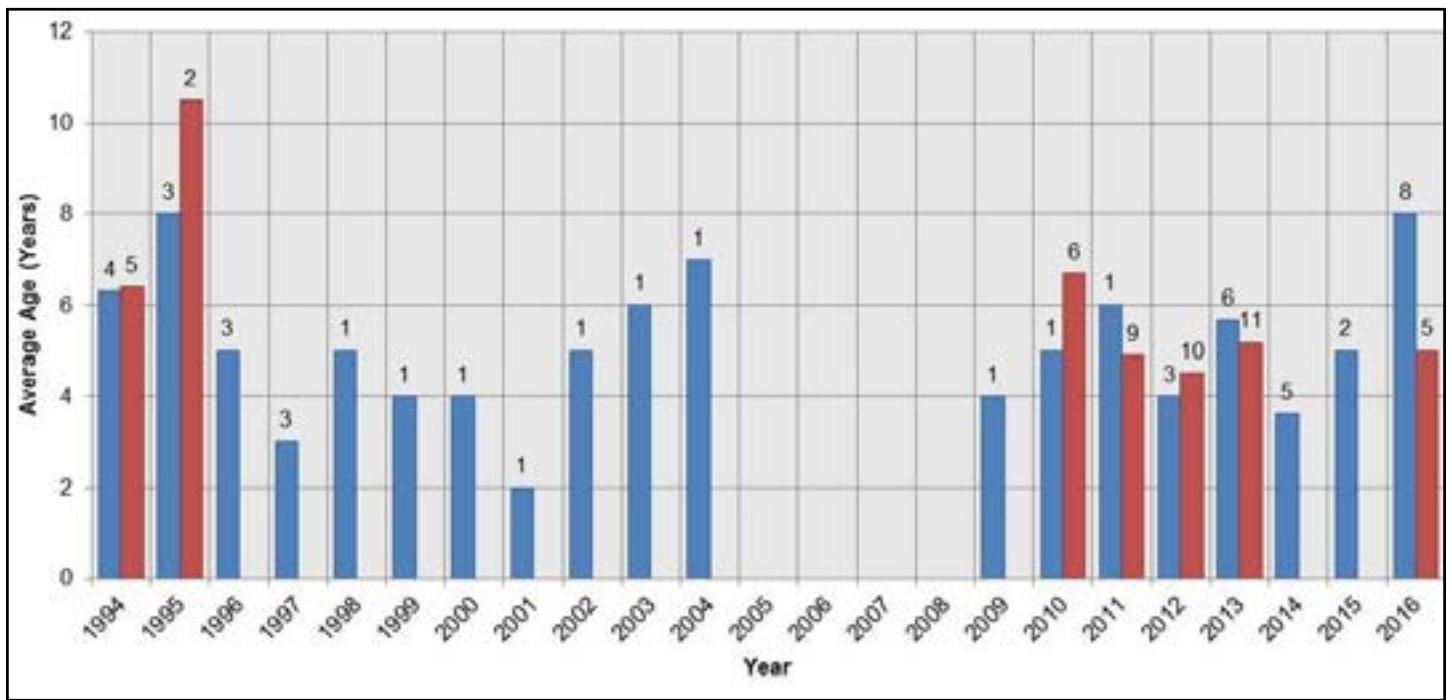
Figure 1. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Bishop Tule Elk Management Unit, 1989 - 2016. Sample sizes are denoted above bars for each year.



■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

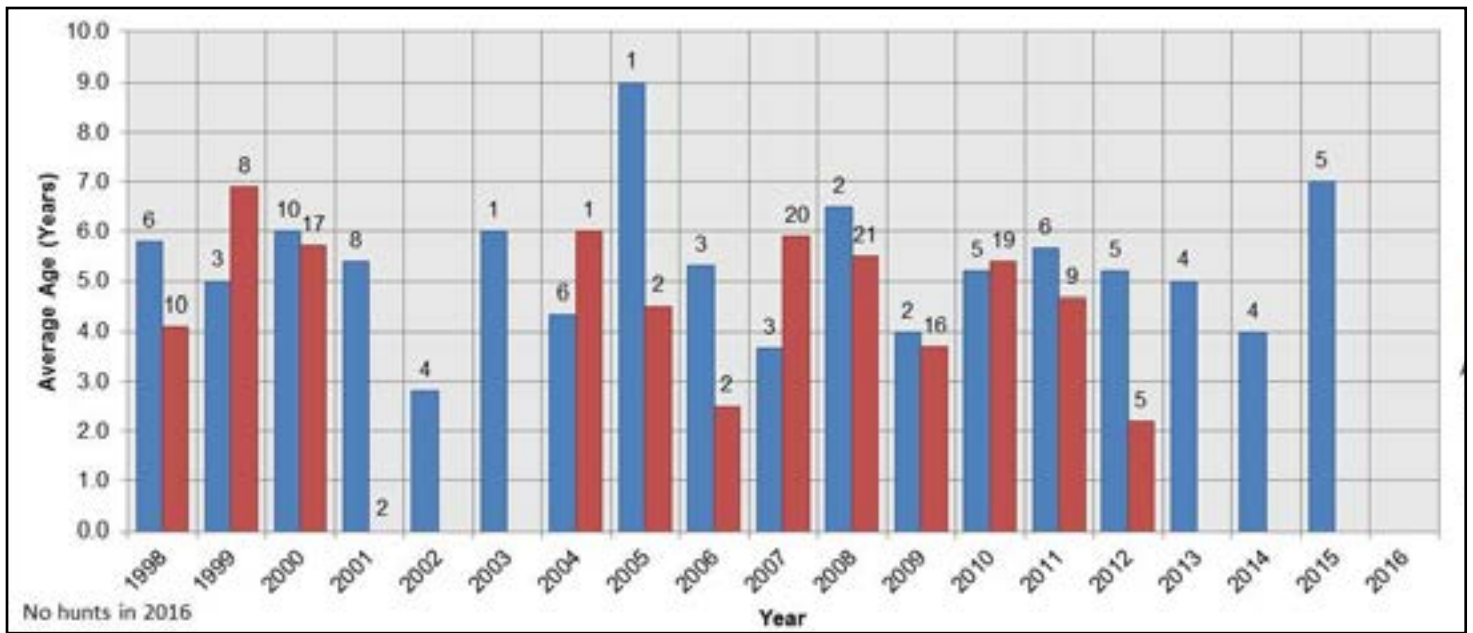
Figure 2. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Lone Pine Tule Elk Management Unit, 1989 - 2016. Sample sizes are denoted above bars for each year.



■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 3. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Independence Tule Elk Management Unit, 1994 - 2016. Sample sizes are denoted above bars for each year.

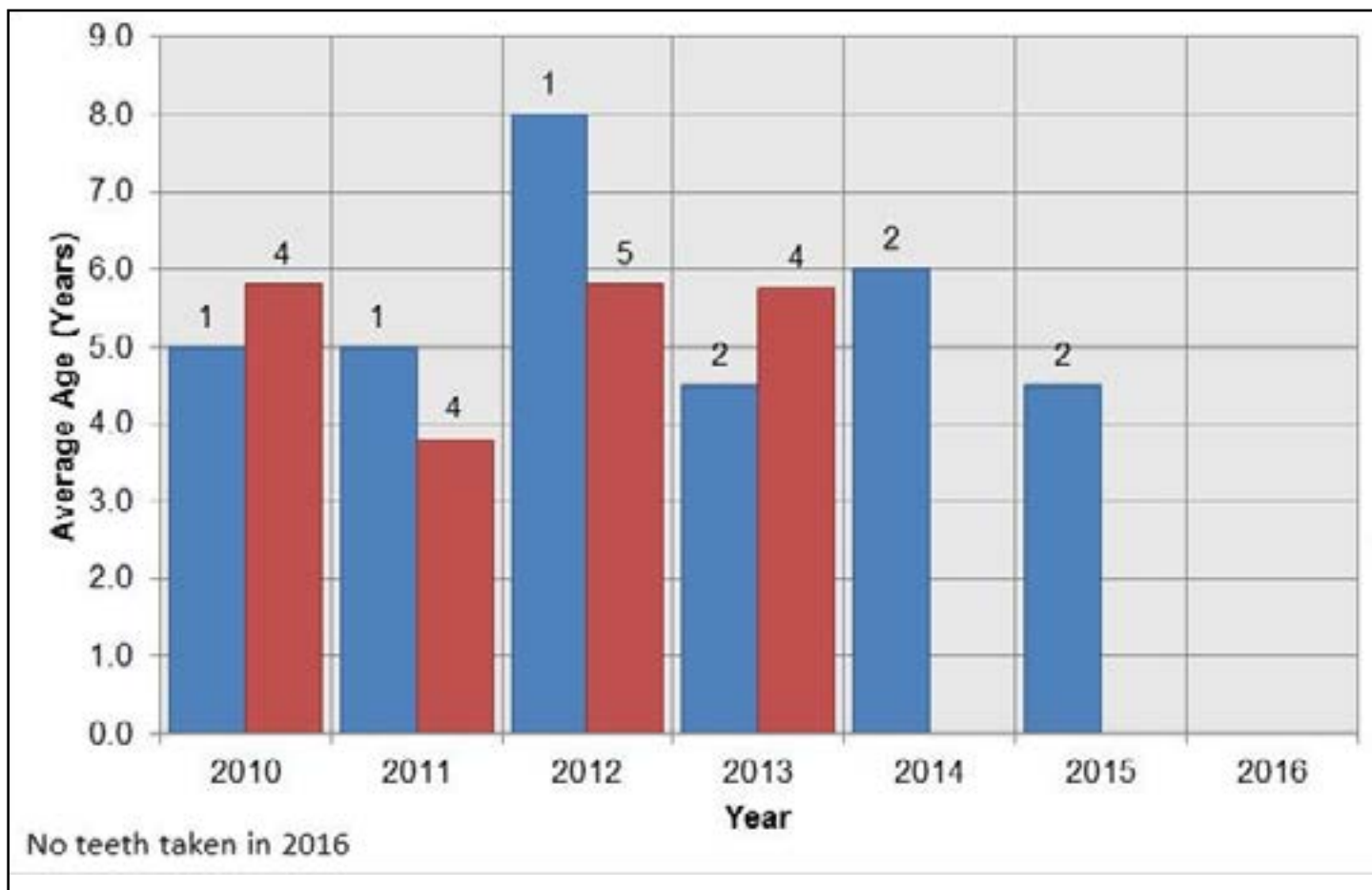


■ Bull

■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 4. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Tinemaha Tule Elk Management Unit, 1998 - 2016. 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.



■ Bull
■ Antlerless

Average age depicted if $N > 1$, and individual age if $N = 1$.

Figure 5. Average Age of Antlered and Antlerless Elk taken by Public Hunting within the Whitney Tule Elk Management Unit, 2010 - 2016. Sample sizes are denoted above bars for each year.

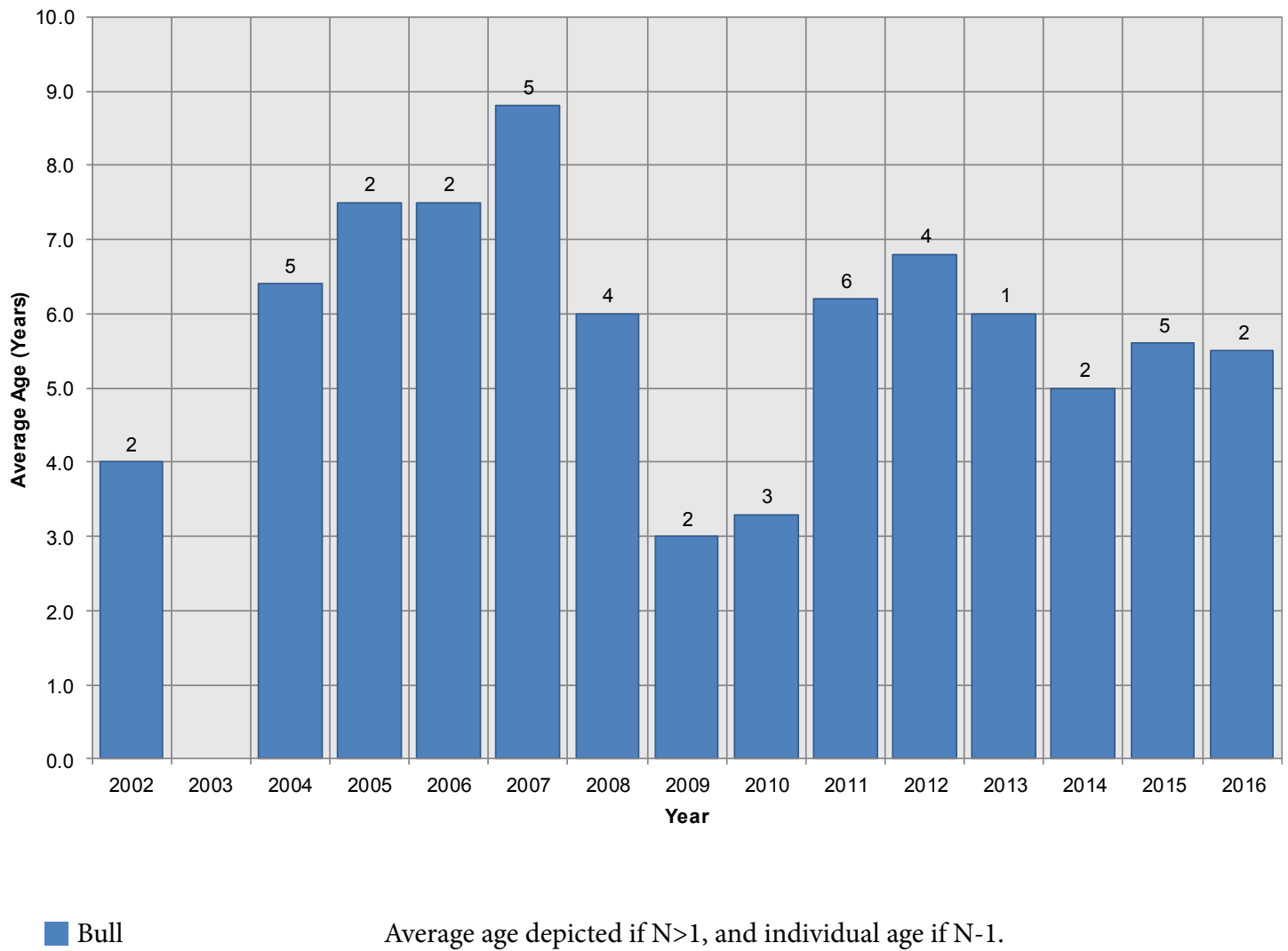
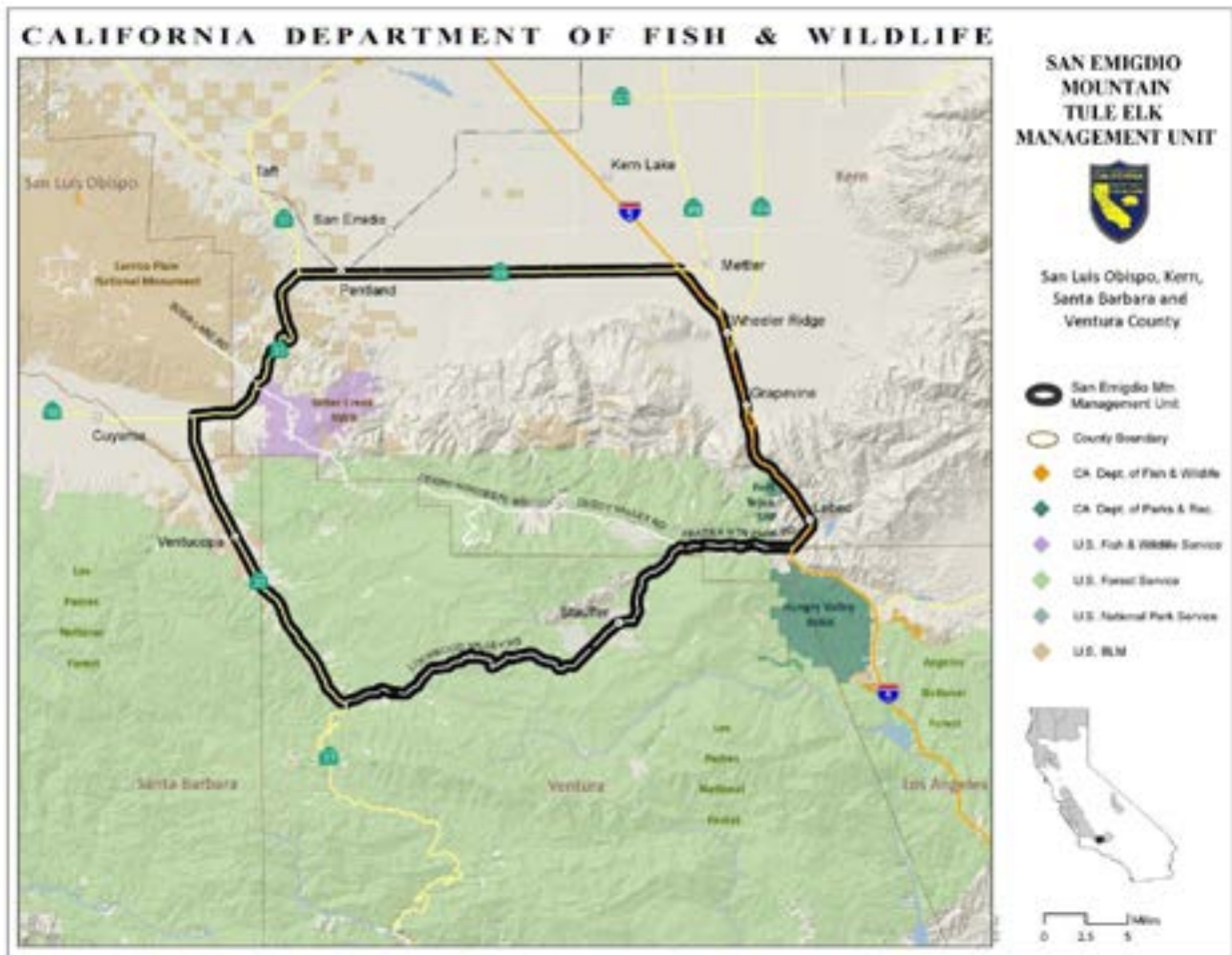


Figure 6. Average Age of Antlered Elk taken by Archery Only Hunting within the Owens Valley Tule Elk Management Unit, 2002 - 2016. Note: Age data for 2011 Includes One Tag Issued through Cooperative Elk Hunting. Sample sizes are denoted above bars for each year.

San Emigdio Mountain Tule Elk Management Unit



San Emigdio Mountain Tule Elk Management Unit

Description

The San Emigdio Mountain 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) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. hunting and wildlife 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.

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. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 size, density, age structure, fecundity (birth rates), mortality (death rates), sex ratio, 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 the public to use and enjoy elk (e.g. 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 Mountain 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-acre Tejon 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 Mountain 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.

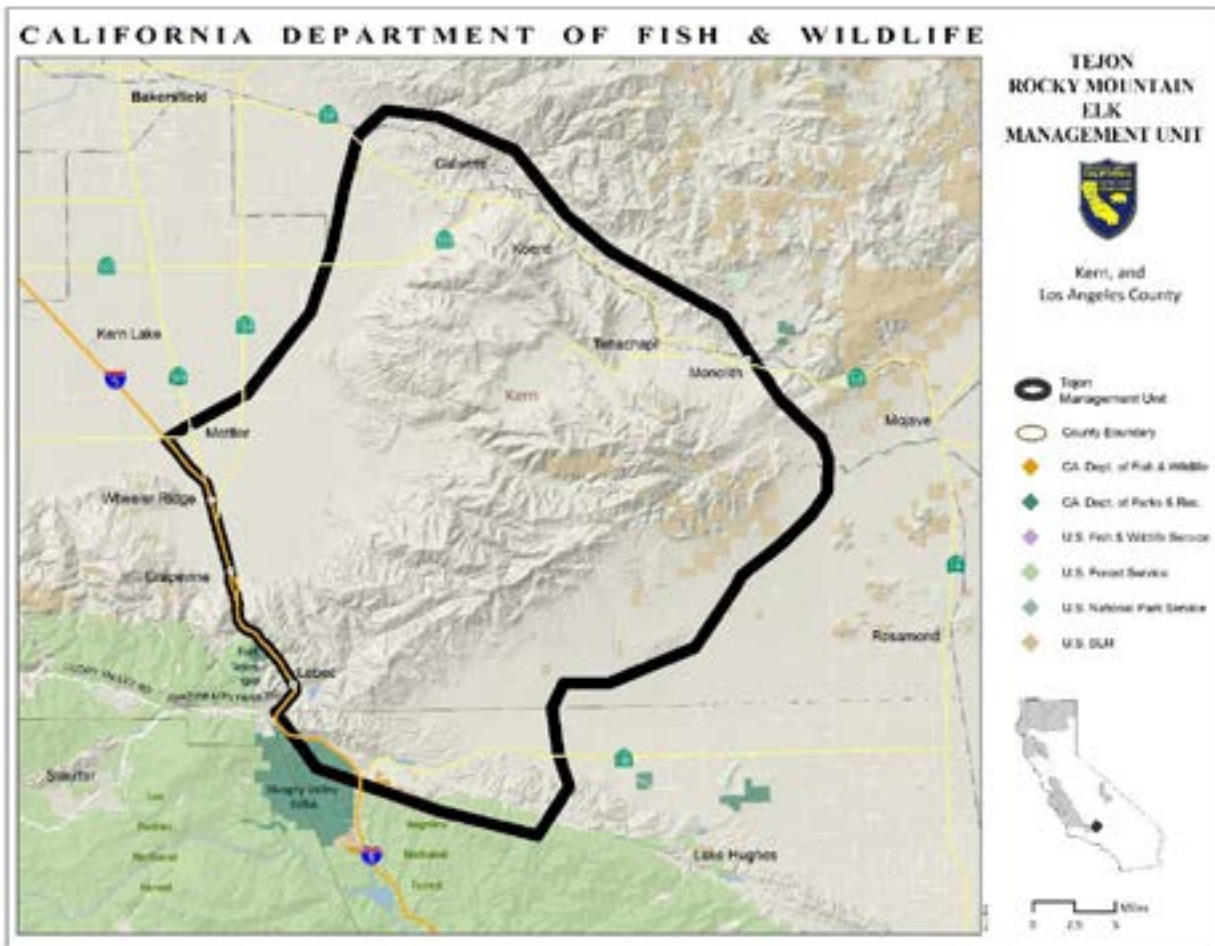
McCullough, D.R. 1969. The tule elk, its history, behavior, and ecology. University of California Publication in Zoology 88. University California Press, Berkeley, USA.

Data Tables/Figures

Table 1. Tule Elk Ground Surveys for the San Emigdio Mountain 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



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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 Game (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.

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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).

Employees of the Tejon Ranch completed elk surveys presented in Table 1. These surveys represent observations within the Tejon Ranch itself. Additional elk are known to inhabit two large ranches and two communities in Cummings Valley, adjacent to the Tejon Ranch property. Population levels may be higher than currently estimated and additional survey effort that includes these other areas is needed.

Management Goal, Objectives, and Actions

The management goals for this Unit are to: 1) In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels; 2) enhance opportunities for the public to use and enjoy elk (e.g. 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. The Tejon Ranch has placed 240,000 acres in conservation easements, which includes large acreages of suitable habitat. 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 further beyond land owned by the Tejon Ranch. These strategies could involve establishing a public hunt zone.

Goal 1. In consideration of current habitat capacity, other land uses, and long term environmental changes, improve elk habitat conditions and population levels.

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 Department considers the possibility of hybridization to be minimal due to landscape level obstacles such as Interstate 5, but will continue with monitoring. 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. The Tejon Ranch has worked with the Natural Resource Conservation Service (NRCS) to add additional water sources for wildlife. 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, NRCS, 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 the public to use and enjoy elk (e.g. 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 Mountain 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 Mountain and Tejon units to ensure that a barrier to movement continues.

Summary of Annual Harvests

The Fish and Game Commission (Commission) 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 Commission 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 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.

Literature Cited:

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.

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.

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.

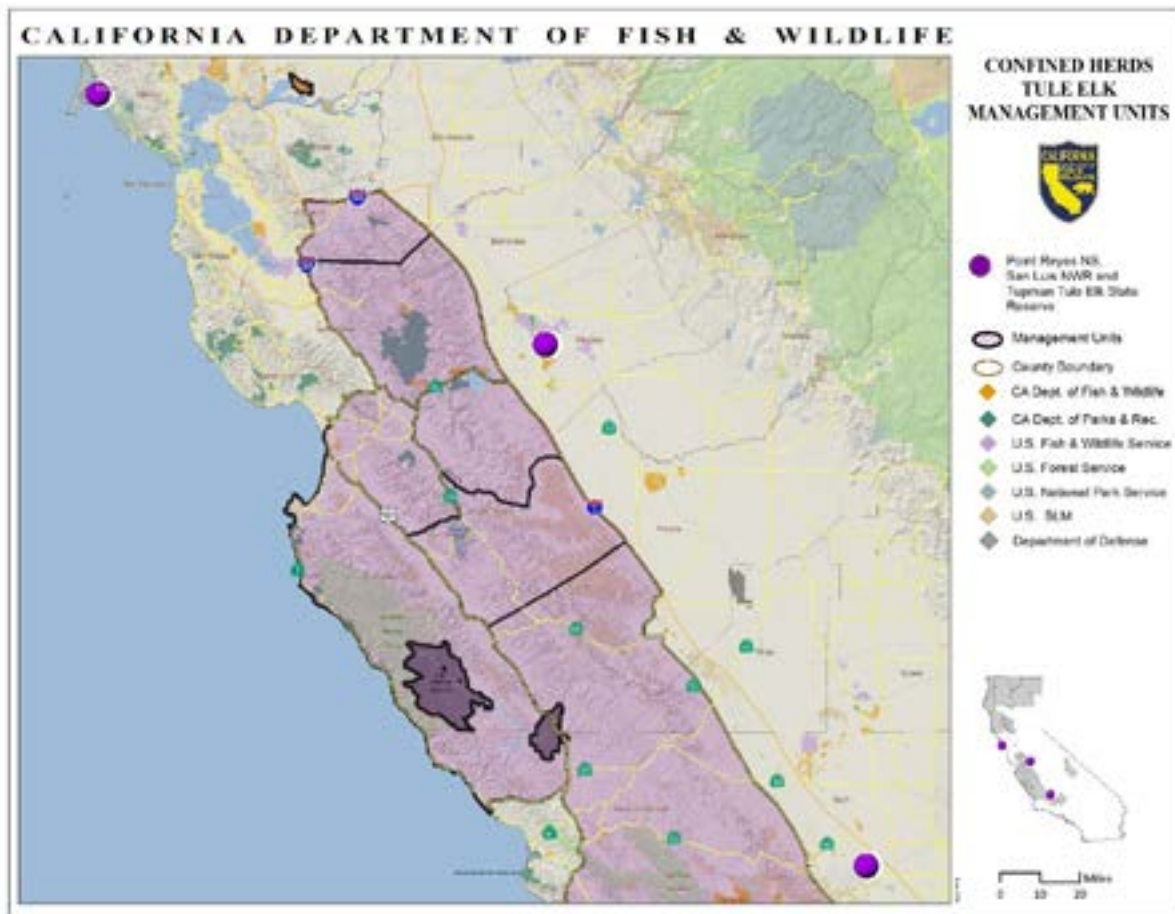
Year	Bulls/100 Cows	Calves/100 Cows	Total
1995	53	47	68
1996	83	44	82
1997	85	45	143
1998	73	41	137
1999	71	48	162
2000	68	38	142
2001	74	40	164
2002	78	37	139
2003	68	42	156
2004	74	38	142
2005	72	39	163
2006	54	28	190
2007	58	31	173
2008	51	29	124
2009	38	30	261
2010	42	40	307
2011	40	44	320
2012	58	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 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, 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. The historical Buttonwillow resolution shaped later decisions to place elk into enclosures at San Luis Refuge and Tomales Point during the 1970s(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 that 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 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 500 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.

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, with the following recommendations: 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 addition, the 1998 Environmental Assessment established population objectives of 350-

450 elk for Tomales Point and 250-350 for the free-ranging herd.

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 Johnes'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. Within days of their release, two cow elk moved from the Limantour area to Drakes Beach, whereby 2011 a separate herd was established after the arrival of a bull elk and additional cows. In recent years, there has been no evidence of mixing between the Limantour and Drakes Beach herds, and the two are considered separate herds by PRNS (D. Press, Point Reyes National Seashore, personal communication).

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 a population level above carrying capacity within the enclosure.

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. Reduce the number of confined herds and the frequency for removing excess animals.

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 in elk 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.

Objective 1.1. Eliminate one or more confined herds by 2025.

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.**

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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

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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:

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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.

Greco, S. and P. Huber. 2012. Year 3 final report: an assessment of the central valley ecoregion for potential tule elk habitat and reintroduction. Report to the U.S. Fish and Wildlife Service. Landscape analysis and systems research laboratory, Department Environmental Design, University of California, Davis, USA.

Greco, S.E., P.R. Huber, J. Hobbs, J. Garcia, K. Stromayer, and R. Parris. 2009. Year 1 final report: grasslands ecological area tule elk reintroduction feasibility study. Report to the Rocky Mountain Elk Foundation. Landscape Analysis and Systems Research Laboratory, Department of Environmental Design, 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.

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Bureau of Land Management. 1992. The tule elk in 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.

Fowler, G.S. 1985. Tule elk in California – history, current status and management recommendations. California Department of Fish and Game. Interagency Agreement. #C-698. Sacramento, California, 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.

National Park Service. 1982. Interim tule elk management plan, Point Reyes National Seashore. Unpublished. USDI National Park Service, Point Reyes National Seashore, California, USA.

National Park Service. 1998. Tule elk management plan and environmental assessment. National Park Service, Point Reyes National Seashore, California, USA.

Tule Elk Interagency Task Force. 1979. The management plan for the conservation of tule elk. California Department of Fish and Game, Sacramento, California, USA.

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 Ecological 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 relocated 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					96
1989					109
1990					132
1991					169
1992					205
1993					220
1994					241
1995					288
1996					381
1997					465
1998*	253	234	65		552
1999	174	210	92		476
2000	130	260	61		451
2001	116	254	50		420
2002	145	241	30		416
2003	91	241	50		382
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	130	247	45		422
2010					
2011	140	309	38		487
2012	105	291	101	43	540
2013	122	188	46		356
2014	95	168	23		286
2015	86	170	27		283
2016	77	165	48		290
2017	94	212	97		403

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
2016	140	119	22		281
2017	159	129	41		329

Source: National Park Service, Point Reyes National Seashore.

Appendix F: Summary of the Decline and Recovery of Elk in California

Tule elk occurred only in California. Prior to the arrival of non-indigenous humans, they ranged from Shasta County south to Santa Barbara County, throughout much of the Coast Range and interior oak woodlands and valleys to the Sierra Nevada foothills. Once numbering near a half million animals (McCullough 1969), tule elk populations declined with the gold rush. Despite a statewide ban on elk hunting in 1854 (California Fish and Game 1928), by the late 1860s, tule elk were extirpated from all but one small locale in the southern San Joaquin Valley (McCullough 1969). Market shooting and competition for livestock forage contributed to their demise. Large body size, coupled with their social behavior (i.e. herding) certainly increased their vulnerability to market shooting. However, more important than shooting, livestock competition or conversion of perennial to annual grasslands was the conversion of a vast amount of tule elk habitat to agricultural land uses (McCullough 1969, Koch 1987).

Some thought tule elk were extinct by the 1870s when a group of less than 10 elk was found on the Miller and Lux Ranch in the southern San Joaquin Valley. Henry Miller, a wealthy landowner, set aside some land and provided them with complete protection. These actions saved tule elk from extinction; but also set the stage for an increase in tule elk numbers and expanded distribution due to complete protection, causing considerable private property damage (Fowler 1985, Koch 1987).

By the early 1900s, tule elk on the Miller and Lux Ranch caused extensive damage to fences, crops and pastures (McCullough 1969, Koch 1987). As the herd continued to grow, efforts were made to reestablish tule elk in various parts of the state (Dasmann 1975). These efforts involved primitive capture methods that were generally unsuccessful; many of the relocated herds gradually died out or required relocation to other areas (McCullough 1969).

By 1940 three well established tule elk herds existed in California: the Cache Creek herd in Colusa and Lake counties (California Fish and Game 1922); the Owens Valley herd in Inyo County (outside historic tule elk range); and a penned herd at Tupman Tule Elk Reserve in Kern County (near the site of the Miller and Lux Ranch tule elk herd; McCullough 1969). Private property conflicts occurred with the free-ranging Cache Creek (California Fish and Game 1930) and Owens Valley herds. The potential for private property conflicts discouraged reintroduction of tule elk during this period. Particularly severe conflicts in the Owens Valley were temporarily alleviated with periodic hunts and drastic population reductions which were unpopular with ranchers, sportspersons and animal preservationists (Koch 1987).

Consequently, in 1971 the State legislature enacted the Behr Bill, which prohibited tule elk hunting until the population statewide reached 2000 animals, and directed the Department to translocate tule elk to suitable areas. Thus, in addition to developing safe and effective capture methods, the Department was required to identify suitable translocation sites for a species known for its potential to wander great distances

(over/through fences), damage agricultural crops, and in the absence of population control, adversely impact habitat, other wildlife species and private property. Initially, an ad hoc task force was established to assist in this effort, with representatives from Bureau of Land Management (BLM), National Park Service (NPS), United States Forest Service (USFS), the Bureau of Sport Fisheries & Wildlife (which later became USFWS), State Wildlife agencies from Arizona, California, Nevada and Oregon, and the universities of Michigan (Ann Arbor) and California (Berkeley). Broad task force representation provided significant wildlife management expertise and included an awareness of the conflicts involved with managing elk in other states. The ad hoc task force established habitat criteria and other factors to consider in evaluating potential tule elk reintroduction sites and created an initial list of potential sites (Interagency Task Force 1971).

In 1976, a resolution by Congress endorsed 2000 tule elk as an appropriate national goal and directed federal agencies to make land under their jurisdiction reasonably available for tule elk (Bureau of Land Management 1980). The Tule Elk Interagency Task Force (Task Force) was formally established in 1977 to help meet directives of state and federal legislation. Membership reflected the composition of the initial ad hoc task force and included representatives from BLM (Task Force Chair), NPS, USFWS, USFS, U.S. Navy, U.S. Army, California Department of Parks and Recreation, Los Angeles Department of Water and Power, and the California Department of Fish and Game (CDFG) (California Department of Fish and Game 1978). The Task Force was assigned the following responsibilities: 1) Analyze the management proposals for each tule elk herd in California; 2) Establish a list of projects needed to preserve and enhance tule elk herds; 3) Evaluate the suitability of lands that can reasonably be made available for tule elk; 4) Evaluate the feasibility of achieving and maintaining a population of 2,000 tule elk in California; and 5) Prepare a statewide plan for the conservation of tule elk. CDFG was designated the legal responsibility for translocation operations.

The Task Force prepared *A Management Plan for the Conservation of Tule Elk* (Tule Elk Interagency Task Force 1979). In this plan, the Task Force built upon recommendations of the initial ad hoc task force and established specific criteria for identifying suitable release sites and translocating tule elk. These criteria employed sound biological principles that considered such factors as land ownership, land-use practices and the laws/regulations of the State. Over time, criteria were modified based on experience gained from capturing and translocating elk. While these criteria initially pertained to tule elk, they are useful and applicable to all of California's elk. The criteria are summarized in Appendix G.

The 1979 statewide tule elk management plan served as the foundation for the Department's tule elk management activities. Based on the criteria summarized above, the Task Force identified and prioritized suitable sites within California for tule elk reintroduction. Protection from harvest between 1971 until 1989 (when regulated hunting resumed), combined with an aggressive reintroduction program in which over 1,250 tule elk have been moved to new areas of the State, resulted in a dramatic increase in the statewide tule elk population.

However, as in the past, the increase in elk numbers and occupied range resulted in many of the State's tule elk herds causing private property damage (Koch 1987, California Department of Fish and Game 1991). In response to the increasing level of tule elk damage to property, Assemblyman Hauser introduced legislation (AB 998) in 1987, which amended Fish and Game Code sections 332 and 3951. As amended, Section 332 allows the Fish and Game Commission (Commission) to authorize tule elk hunting if the average of the Department's statewide tule elk population estimate exceeds 2,000 animals. Section 3951 specified that the maximum number of tule elk in the Owens Valley should not exceed 490 individuals and directed the Department to relocate tule elk to suitable areas and report to the Legislature every two years on their status in California (the last report to the Legislature was submitted in October, 2000; legislation in 2001 eliminated future reporting). The statute also requires that, where economic or environmental damage occurs, emphasis shall be placed on managing each tule elk herd at biologically sound levels using relocation, hunting, or other appropriate means determined by the Department.

The statewide tule elk population exceeded 2,000 animals in 1987, and the Commission established regulations under which a limited number of tule elk could be hunted in 1988. However, in September 1988, a citizens group obtained a court order preventing implementation of the regulations, based primarily on a finding that the Commission's decision did not comply with CEQA. In 1989, the Department prepared an environmental document regarding tule elk hunting and circulated the document for review as required by CEQA. The Commission certified the environmental document and adopted regulations providing for the take of tule elk from specific areas in the State. Hunters harvested 84 elk during the 1989 tule elk hunting season. Since 1989, the Department has prepared appropriate environmental documentation to continue annual public tule elk hunting in specified zones while maintaining or enhancing the population statewide.

The increase in numbers and distribution has provided a substantial increase in opportunities for viewing, photographing, and natural history study of tule elk. Currently, there are at least 5,700 tule elk in separate herds throughout California. Four herds (San Luis NWR, Tupman, Point Reyes, and Grizzly Island) have formal interpretive programs providing the public with the opportunity to view, photograph, hunt (Grizzly Island only) and study the natural history of tule elk with assistance provided by experienced State, Federal, or volunteer staff. A tule elk viewpoint along a US Highway 395 has been established for the Owens Valley herd, near the town of Lone Pine. Tule elk are also seen on hillsides near Highway 20 west of Williams, along Highway 101 near Laytonville, and along Highway 41 near Chalome.

Regarding Roosevelt elk, Murie (1951) reported their original distribution extended from the San Francisco Bay northward along coastal forest areas into Oregon and indicated their northern California range extended inland to the Mount Shasta area. Harper et al. (1967) attributed the demise of California's Roosevelt elk to meat and hide hunting during the Gold Rush period and the subsequent influx of non-indigenous people and

domestic animals. Others cited factors related to agricultural and logging activities (California Conservationist 1936). Orr (1937) reported that California Roosevelt elk were restricted to a small portion of northern Humboldt and southern Del Norte counties and faced extirpation. By some accounts, Roosevelt elk had declined to as few as 15 animals (Harn 1958). However Harper et al. (1967) later concluded that their survival was not in danger and speculated that northwestern California may have contained from 1,000-2,000 elk.

Based on the current distribution of Roosevelt elk in California, the population has grown and expanded its range since 1967. Public ownership (USFS, BLM, NPS, and State Parks) of large tracts of Roosevelt elk habitat and associated Congressional mandates and directions to provide for and maintain wildlife habitats have resulted in Roosevelt elk population increases (CDFW unpublished data). Populations of Roosevelt elk currently exist in coastal areas of Mendocino, Humboldt, and Del Norte counties, along with interior Cascade and Klamath mountain ranges in Shasta, Siskiyou, and Trinity counties. Some of these populations were established when the Department (in cooperation with other State and Federal agencies) relocated elk to suitable historic range (CDFW unpublished data). During the 1980s and 1990s, the Department worked in cooperation with the Oregon Department of Fish and Wildlife, USFS, and BLM, to relocate Roosevelt elk to suitable unoccupied historic range. Capturing Roosevelt elk for relocation has been difficult, due to their use of dense vegetation and small group sizes. However, from 1985 through 2000 the Department translocated more than 350 Roosevelt elk to re-establish populations in portions of southern Humboldt, Mendocino, Siskiyou, and Trinity counties.

The tendency for elk to disperse, individually or in small groups, beyond core distribution areas in northern California has been documented. Harn (1958) and Harper et al. (1967) reported elk observations in other portions of Del Norte and Humboldt counties, as well as in Siskiyou and Trinity counties. Sightings of elk in eastern Siskiyou County (east of Interstate Highway 5) were reported as early as 1965 (CDFW files). The ability of elk to travel significant distances was demonstrated when, over a two week period in 2001, elk monitored by CDFW with telemetry/GPS methods traveled approximately 120 miles (point-to-point distance) from Montague (Siskiyou County) to Madeline (Modoc County) in northeastern California. Thus, elk are capable of dispersing into suitable unoccupied habitat and it is likely that some northern California populations became established through dispersal from Oregon or other California locations. The Department currently estimates the statewide Roosevelt elk population at approximately 5,700 individuals.

Some elk also were released on the Hearst Ranch near San Simeon (San Luis Obispo and Monterey counties); details regarding dates, numbers, subspecies are unknown. William Randolph Hearst had widespread contacts and secured various exotic wildlife species for the Hearst Ranch zoo, which could have included red deer as well as Roosevelt, Rocky Mountain and tule elk. Many animals were released to free-ranging conditions in the 1930s. Elk persist in the San Simeon area, and could be hybrids according to McCullough (1969) and Dasmann (1975).

Elk also were brought to Santa Rosa Island (Santa Barbara County) around 1910 for hunting purposes. These have been variously reported as Rocky Mountain, tule and Roosevelt elk. The NPS purchased Santa Rosa Island in 1986, with plans to eliminate all elk from the island. This was accomplished by 2012.

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Appendix G: Tule Elk Translocation Criteria.

1. Free-roaming - Herds will be free-roaming and managed as part of the ecosystem.
2. Historical Range - Translocations are limited to historic range.
3. Habitat Quality - The site must contain suitable conditions for providing year-long elk habitat. This includes natural vegetation capable of providing forage and cover, adequate perennial water and relatively moderate climatic conditions receiving only moderate snow.
4. Hybridization with Other Elk - The site should provide no chance of contact with other subspecies of elk.
5. Potential for Public Use - Preference shall be given to sites which increase opportunities for public use of tule elk, including hunting. Preferred sites will be on or adjacent to accessible public lands
6. Conflicts with Humans - Tule elk will not be translocated to areas with a potential for significant conflicts with humans (agriculture, highways, and subdivisions); the rights of private landowners must be respected. A site should have low potential for elk damage to private property. This includes livestock competition and damage to agricultural and silvicultural crops as well as other property such as fences and irrigation systems. Adjacent landowners should understand and support the proposed relocation of tule elk. Private landownership is dynamic, and acceptable conditions may become depredation problems with a change in land use or the sale of neighboring parcel. Written agreements with neighboring landowners are recommended.
7. Population Management - Practical means of regulating population size should be available for translocated tule elk herds.
8. Competition with Other Wildlife - The status of other native ungulates and threatened and endangered species in the area of a proposed tule elk translocation should be considered as well as the potential for adverse impacts from competition.
9. Disease - Elk should not be relocated from or to areas with a chronic disease history where disease may affect elk or other ungulates.
10. Existing Populations - Tule elk will not be relocated to sites with or immediately adjacent to existing populations, unless additional elk are needed to improve the status of a population.

Appendix H: National Forest Management Act, Elk Population Status for selected forests in the western United States and Minimum Viable Population for each EMU:

Table 1 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, also included additional 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 1 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 and no longer specify MVP levels for elk.

Table 2 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 2 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.

Table 1. 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).

Forest State Size in acres	ELK POPULATION STATUS	Notes/Sources
	Reported Size (Year or Season in Parenthesis) Potential (projected maximum) Size Population Objective Minimum Viable Population (MVP) Level	
		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. (<i>C. c. roosevelti</i>) 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 2. Elk Population Status reported by State Agencies, Western United States.

State	Reported Elk Population Level (subspecies) (year)	Statewide Elk Population Objective	Herd/Unit/Zone Population Objectives	Sources
Montana	115,500 (<i>nelsoni</i>) (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 (<i>nelsoni</i>)	Not Quantified	28 Zones (Objectives range from <500 – 11,000 elk).	2014 Statewide Elk Management Plan.
Utah	81,000 (<i>nelsoni</i>)	71,000 (sum of individual unit objectives)	38 Units. (Objectives range from 0-12,000 elk).	2015 Statewide Elk Management Plan.
Colorado	265,000 (<i>nelsoni</i>) (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 (<i>nelsoni</i>) 60,000 (<i>roosevelti</i>)	72,050 (<i>nelsoni</i>) 72,450 (<i>roosevelti</i>)	Winter population objectives established for 35 <i>nelsoni</i> and 24 <i>roosevelti</i> units; range from 120-8,000 elk.	2003 Statewide Elk Management Plan. 2016 Elk Management Objectives for Roosevelt, Rocky Mountain Elk.
Nevada	16,000 (<i>nelsoni</i>)	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 (<i>nelsoni</i> , <i>roosevelti</i> , 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 (<i>nelsoni</i>) (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 (<i>nelsoni</i>) (2009)	Not Quantified		Walker 2011.
Wyoming	110,000 (<i>nelsoni</i>) (2009)	Not Quantified		Shultz and Lutz 2014.

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 2 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 2; 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.

Using the information provided in Table 1 as a rough estimate for calculating MVP (MVP/reported population size) reveals that MVP was approximately 35% of the

reported population size. Using this rough calculation the Department calculated MVP for each EMU based on current population size (Table 3).

Table 3. Calculated Minimum Viable Population (MVP) for each Elk Management Unit.

EMU	Population Estimate	MVP Utilizing 35% of Population Estimate
North Coast	1600	560
Marble Mountains	3000	1050
Siskiyou	1000	350
Northeastern	1000	350
Mendocino Roosevelt	115	40
Mendocino Tule	1100	385
Lake Pillsbury	125	44
Cache Creek/Bear Valley	350	123
East Park Reservoir	120	42
Grizzly Island	300	105
Alameda	100	35
Santa Clara	150	53
Salinas/Fremont Peak	225	79
San Luis Reservoir	350	123
Central Coast	150	53
Hernandez Res./S. San Benito	225	79
La Panza	800	280
Fort Hunter Liggett	250	88
Camp Roberts	300	105
Owens Valley	280	98
San Emigdio Mountain	350	123
Tejon	300	105
Confined Herds	400	NA

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Appendix I: Elk Survey Methods for Population Monitoring:

Method	Summary Description	Recent Example
Aerial surveys with sightability adjustment	Elk are counted from a helicopter. GPS-collared elk are required to fit a sightability model used to adjust counts based on detection probabilities from the modeling. Once a model is developed, the sightability correction can be used to survey unmarked elk, but the modeling should be updated on a regular basis (e.g., every 5-10 years). This method is not suitable for densely vegetated areas because some elk groups may never be observed such that their probability of detection is effectively zero.	McCorquodale et al. 2012
Aerial surveys with capture-recapture	Elk are counted from a helicopter. Observers track marked versus unmarked elk. Capture-recapture or spatial recapture modeling can be used to robustly estimate density, but a large number of GPS-marked elk are required. A pilot study may be necessary to estimate how many elk need to be marked. This method may be suitable in densely vegetated areas.	McCorquodale et al. 2012
Fecal DNA	Transects are walked to recover elk scat. The samples are genotyped by a laboratory and the detection history of identified individuals is used in spatial capture recapture modeling to estimate density. Unbaited camera stations are used to help break out densities by sex and age class. Preliminary species distribution modeling is used to guide a stratified sampling design.	Batter et al. 2018
Small area methods	In some instances, alternative survey methods and sampling designs may be more efficient for small study areas (e.g., Grizzly Island, Point Reyes, San Luis Reservoir). These methods include near-censuses based on repeated ground counts in open habitats, fecal DNA surveys, and aerial counts using small unmanned aerial vehicles (UAVs) fitted with visual and/or thermal cameras.	Cobb 2010 Chretien et al. 2016 Brazeal and Sacks 2017

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