ELK CONSERVATION AND MANAGEMENT PLAN

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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 evaluated 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 used 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, cameras 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	0	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 variations 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 lifestock 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 Department 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 Title14, 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 habitat. 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 ungulate habitat conditions are identified, actions by the Department may be limited if impacts are occurring on lands managed by other public land agencies and or under private ownership. The Department will coordinate with these public and private landowners to address habitat conditions in need of improvement.

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 cooperation 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 identification 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 distribution 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 agreement 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

VIII. LIST OF FIGURES AND TABLES

FIGURES

TABLES