SUPPLEMENTAL ENVIRONMENTAL DOCUMENT

Section 364, 364.1, 555, and 601
Title 14, California Code of Regulations

Regarding



ELK HUNTING

SCH 2018112037

May 10, 2019

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE
on behalf of the California Fish and Game Commission

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CHAPTER 1. SUMMARY

PROPOSED PROJECT AND ALTERNATIVES

The proposed project involves modifications to the current elk hunting regulations for the 2019-2020 elk hunting season and subsequent seasons until the Fish and Game Commission (Commission) adopts new regulations modifying tag limits. Specifically, the Commission proposes to:

- Increase the tag quota range (by 20 tags) in the Northwestern Elk Zone.
- Increase the individual quotas in the other zones, but within previously analyzed quota ranges
- Modify season dates for Fort Hunter Liggett consistent with section 3453 of the Fish and Game Code (FGC). No changes in tag quotas are proposed.

The analysis in the 2019 Supplemental Environmental Document (SED) focuses on the potential for any new significant or substantially more severe environmental impacts from the increase in tag quota range in the Northwestern Elk Zone. Impacts from any tag modifications within other zones in the state are analyzed within the 2010 Environmental Document (incorporated by reference, April, 2010 Final Environmental Document, SCH#200912083, available at 1812 9th Street, Sacramento, CA 95811). The Commission finds the analysis in the 2010 Environmental Document still contains informational value and is appropriate to use as a basis for the proposed quota changes in zones other than the Northwestern Elk Zone.

The Department of Fish and Wildlife (Department) also provides, and the Commission is considering, three alternatives to the proposed project that could feasibly attain the basic objectives of the project. Alternative 1 (no change) would maintain the existing analyzed harvest for the hunt zone without change. Alternative 2 (increased harvest) involves an increase of 60 tags (three times that of the proposed project). Alternative 3 (reduced harvest) involves a harvest increase of 10 tags (half that of the proposed project). Current and proposed harvest strategies generally allow for population growth through time. However, under the Increased Harvest alternative, population growth might be curtailed and/or decline slightly over time.

SUMMARY OF IMPACTS AND MITIGATION

Table 1 summarizes the Commission findings of no significant long-term adverse impacts associated with the proposed project or any of the project alternatives considered for the 2019-20 elk hunting regulations.

Table 1. Impact Summary

Alternative	Description	Significant Impact	Mitigation
Proposed Project	Increase the tag quota range for the Northwestern Elk Zone by 20 tags	No	N/A
Alternative 1. No Project	No change from the 2018-19 hunting regulations	No	N/A
Alternative 2. Increase Tag Quota (3 x proposed project)	Increase the tag quota range for the Northwestern Elk Zone by up to 60 tags	No	N/A
Alternative 3. Reduced Proposal (half of Proposed Project)	Increase the tag quota range for the Northwestern Elk Zone by 10 tags	No	N/A

Based on success rates from previous years, the Department expects that the actual harvest will range from 80-95 percent of the elk tags allocated for 2019 (CDFW, 2018).

State role in establishing elk hunting regulations

The SED is intended to support the actions of the Commission as it considers regulations pertinent to conservation and providing public recreational opportunities. The Commission has prepared this document to analyze the potential of any new significant or substantially more severe environmental impacts than were previously disclosed in an Environmental Document prepared in 2010. These actions are consistent with the wildlife conservation policy adopted by the Legislature as set forth in Section 1801, FGC. The State's wildlife conservation policy, among other things, specifies an objective of providing hunting opportunities consistent with maintaining healthy wildlife populations.

Elk hunting regulations adopted by the Commission are set forth in Sections 364, 364.1, and 555, Title 14, California Code of Regulations (CCR), and enforced by the Department. These regulations are authorized under the following statutes:

Section 203, FGC, authorizes the Commission to regulate game mammals in the state.

Section 203.1, FGC, requires the Commission to consider populations, habitat, food supplies, the welfare of individual animals, and other pertinent facts when adopting hunting regulations for elk.

Section 332, FGC, provides that 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.

Sections 3950 -3952, FGC, designate elk (genus *Cervus*) as a game mammal in California; authorizes the Commission to regulate take (harvest) of elk; and requires the Department to prepare an elk management plan.

FGC Section 3952 was adopted in 2003 and requires the Department to develop a statewide approach for management of elk. FGC Section 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

FGC Section 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. FGC Section 3952 directs the Department to develop a statewide elk management plan, consistent with the Conservation of Wildlife Resources Policy, and maintain sufficient elk populations in perpetuity, while considering the following:

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

An Elk Conservation and Management Plan (CDFW 2018) 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 and actions for elk management, referred to as Elk Management Units (EMUs) and establishes broad conservation and management objectives. The plan provides guidance and direction to help set priorities statewide, and establishes general policies, goals and objectives, on a statewide scale. Individual EMU documents address issues specific to the units, establish population objectives and future management direction.

The 2019 Elk Hunting SED sets forth the findings of the Commission, based on recommendations from the Department, and the Commission's proposal for regulatory changes.

TRIBAL COORDINATION

The Department is committed to developing and maintaining an effective, positive and cooperative relationship with California federally recognized Tribes (Tribes) regarding elk management. 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 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.

A letter to Tribal Representatives on November 7, 2018 provided notification of the Department's proposal to amend hunting regulations for elk pursuant to the California Environmental Quality Act (CEQA), Public Resources Code Section 21080.3.1. The letter described opportunities to provide input to the proposed regulations through consultation pursuant to Public Resources Code sections 21080.3.1 and 21030.3.2, or during the public comment period for release of this Draft Supplemental Environmental Document.

AREAS OF CONTROVERSY

A Notice of Preparation (NOP) for the proposed project was prepared and circulated on November 13, 2018. The Department presented information on potential changes to elk hunting regulations at the September 20, 2018 Wildlife Resources Committee (WRC) meeting held in Sacramento. One scoping meeting, held from 12:00 P.M. to 1:00 P.M. on Friday November 30, 2018 was also conducted at the Department's Wildlife Branch located at 1812 9th Street, Sacramento CA 95811.

The WRC meeting provided information to the Committee, public and Commission staff about potential changes being considered and evaluated. The scoping meeting solicited input from the public and interested public agencies regarding the nature and scope of the environmental impacts to be addressed in the SED. At the beginning of each meeting, staff presented an overview of the existing program, the objectives of the

proposed project, the legal background leading to this SED, and the CEQA process generally. During the scoping meeting, participants also were encouraged to submit written comments, or to submit additional comments by mail or email before close of the comment period on December 14, 2018. Three members of the public attended the meeting. No areas of controversy regarding the proposed project were identified at the meeting.

Attendees:

Name	**Affiliation**	**Email**
Victoria Barr	CDFW	Victoria.barr@wildlife.ca.gov
Brad Burkholder	CDFW	Brad.burkholder@wildlife.ca.gov
Nick Villa	CRPA	nvilla@CRPA.ORG
Joe Hobbs	CDFW	Joe.hobbs@wildlife.ca.gov
Rose Sanchez	CSUS	rosesanchez@csus.edu
Ari Cornman	FGC	ari.cornman@fgc.ca.gov
Jessica Whalen	None	jnw179@humboldt.edu
Jon Fischer	CDFW	Jon.fischer@wildlife.ca.gov
Regina Vu	CDFW	Regina.vu@wildlife.ca.gov
Julie Garcia	CDFW	Julie.garcia@wildlife.ca.gov
Andrew Trausch	CDFW	Andrew.trausch@wildlife.ca.gov

Oral Comments

Nick Villa requested more junior only elk hunts. No other comments were received during the scoping meeting.

Written Comments Received During 30-Day Comment Period

In total, three emails and three letters were received from six distinct individuals during the scoping process. Individual letters or emails often contained more than one scoping-related comment; these have been separated out and grouped accordingly.

1) Two emails requested completion of the statewide elk management plan before changes to the current elk hunting program were implemented.
2) One email requested: to please provide to the requestor as well as the public scientific research that supports the Department's proposal to kill more elk is biologically sound.
3) One email stated: a majority of elk tags should be awarded through random draw instead of using preference points; lack of hunter recruitment and retention is one of many factors that will negatively impact conservation efforts in the future; a lack of opportunity is the leading cause of lack of hunter retention; and I am not sure what it would take to markedly improve the number of elk in California, but

whatever habitat work or predator control that can be done to increase elk numbers should be taken into consideration and made a top priority.

4) One letter outlined the CEQA requirements the Department needs to comply with.
5) One email stated: Tribal hunting should be the first and highest priority for existing hunting tags; Separate the Northwestern Elk Zone into two elk zones, Del Norte County and Humboldt County; and Roosevelt elk in the Northwest, CA Hunt Zone are genetically pure or unique They also requested:
    a) Present in detail, all elk population data collected to date and used as a basis for any proposed increase in hunting tags.
    b) Present all data showing how many elk are actually killed each year in each program including PLM and SHARE, Tribal hunts, and including poached elk (e.g. recent 2018 poaching in Redwood National & State Parks; 2018 apprehended poachers in Gilbert Creek area) and road kill. Please show respective locations on a map, or at least break out by County and general areas within counties.
    c) We request improved transparency throughout the process. Proposed numbers of tags and categories for all hunts: General, SHARE, PLM, Apprentice, Tribal, etc. should easily accessible such that a given agency, region or county can grasp and analyze the impacts to their region, county or neighborhood. These proposed quotas should be locally published well before the Commissioners' meeting dates so communities have a greater opportunity to voice their support or concerns.
    d) Indicate which elk population data are based on actual field counts, surveys and other methods involving actual sighting or handling of the elk by authorized personnel -- and which population data are projected from field data by mathematical formulas and other methods in use by the Humboldt State University (HSU) /CDFW team (and/or other experts consulted by this team).
    e) Explain clearly which of these methods for projecting elk population numbers are being used; where else and by whom these methods are in use, and to what extent these projection methods have been published and peer-reviewed.
    f) Note if any portion of the population counts/data is based directly on reports/counts from the public (or local businesses or ranches etc.).
    g) Chart the progression or changes in estimated elk population numbers and/or databased population numbers over the last 10 years, and over the last 150 years.
    h) Explain how proposed hunting tag increases will fulfill the existing or draft Elk Management Plan population goals for this region.
    i) Discuss how elk are significantly impacted by recent fires in surrounding areas of Southern Oregon and Northern California, and how this combined with any proposed increased hunting pressure impacts the elk in the Northwestern CA Hunt Zone.

j) We should compensate by allowing elk to increase their numbers and find refuge in nearby areas such as ours, to compensate for losses in elk or elk habitat.
k) Explain all reason(s) including biological justification for the proposed increase in elk tags when the HSU/CDFW data gathering and studies are not complete, have not been published, released, or peer-reviewed.
l) CDFW is proposing for the 2018 Elk Tag Allocation adjustments within the quota ranges allowed under the old outdated elk management plan, a plan not supported by scientific evidence.
m) Show how the proposed increase in tags is spread over the categories of General Hunt; PLM; SHARE, and the allocation for Tribal Hunts/Tags. Please show respective locations on a map, or at least break out by County and general areas within counties.

Note: No comments were received that pertained directly to Aesthetics, Agriculture and Forestry Resources, Air Quality, Cultural Resources, Geology/Soils, Greenhouse Gas Emissions, Hazards and Hazardous Materials, Hydrology and Water Quality, Land Use/Planning, Mineral Resources, Noise, Population/Housing, Public Services, Recreation, Transportation/Traffic, Tribal Resources, or Utilities/Service Systems.

RESOURCE AREAS ANALYZED IN THIS DOCUMENT

This SED analyzes the potential for significant impacts to Biological Resources and Recreation, as well as Cumulative Impacts. After using an initial study (Appendix 1), in combination with the comments received during the scoping period, to evaluate the potential environmental impacts of the project, the other resource areas were eliminated based on the Commission's determination that there was no potential for significant impact in those areas.

ISSUES TO BE RESOLVED

As provided by existing law, the Commission is the decision-making body (lead agency) considering the proposed project, while the Department has responsibility for management activities, such as hunting, translocating elk to suitable historic range, and preparing management plans. The primary issue for the Commission to resolve is whether to change elk hunting regulations as an element of elk management. If such changes are authorized, the Commission will specify the areas, seasons, methods of take, bag and possession limit, number of elk to be taken, and other appropriate special conditions.

FUNCTIONAL EQUIVALENCY

The California Environmental Quality Act (CEQA) requires all public agencies in the State to evaluate the environmental impacts of projects they approve, including regulations, which may have a potential to significantly affect the environment. The Department, on behalf of the Commission has prepared this SED, which is the functional equivalent of a Supplemental Draft Environmental Impact Report (as

discussed in Public Resources Code section 21166). The SED provides the Commission, other agencies, and the general public with an objective assessment of the potential new significant or substantially more severe environmental impacts than were previously disclosed in the 2010 Environmental Document effects.

Generally, the Commission's CEQA review of proposed project adopting a regulatory change is conducted in accordance with the Commission's certified regulatory program (CRP) approved by the Secretary for the California Resources Agency pursuant to Public Resources Code section 21080.5 (See generally CCR Title 14, sections 781.5, and 15251(b)). The 2010 Environmental Document fell under the Commission's CRP. Because Public Resources Code section 21166 does not fall within the limited exception for CRPs provided by section 21080.5, the Commission has prepared this SED and conducted related environmental review of the proposed program in accordance with CEQA generally, also following the rulemaking process for regulations as set forth in the Commission's CRP and the Administrative Procedure Act (Government Code Section 11340 et seq.).

In addition, pursuant to Section 15087 of the CEQA Guidelines, this SED is available for public review for 45 days. During the review period, the public is encouraged to provide written comments regarding the environmental document to the Department of Fish and Wildlife, Wildlife Branch, 1812 9th Street, Sacramento, California 95811. Comments must be received by the Department by 5:00 p.m. on March 30, 2019.

Written and oral comments received in response to the SED will be addressed in a Response to Comments document, which, together with the SED, will constitute the Final Supplemental Environmental Document. In addition, the Commission will consider the comments received pursuant to the Administrative Procedure Act addressing the proposed regulations. The rulemaking process under the Administrative Procedure Act to promulgate regulations is running concurrently with this environmental review pursuant to CEQA. Once completed, the Final Supplemental Environmental Document will inform the Commission's exercise of discretion as lead agency under CEQA in deciding whether or how to approve the proposed project as described in this document and the proposed regulations.

CHAPTER 2. THE PROPOSED ACTION

The proposed project being considered consists of the following modification to existing elk hunting regulations.

1. Increase the Tag Range in the Northwestern Elk Zone

In order to maintain hunting quality in accordance with management goals and objectives, it is periodically necessary to adjust quotas in response to dynamic environmental and biological conditions. This proposed project adjusts the elk tag range (Appendix 2) to account for fluctuations in population numbers, increased property damage, and hunting pressure.

The increase in tags will allow the Department to distribute hunting pressure to address landowner concerns over elk damage and increase opportunity while providing a biologically appropriate harvest within the Northwestern elk zone. Bull (0-28), antlerless (0-34), and either-sex (0-3) tags would be available to the public during the Northwestern elk hunt and through the SHARE Program.

Elk Pop (Smith and Updike 1987) is a microcomputer-based model developed by the Department for the purpose of analyzing harvest alternatives. Elk Pop was used to assess effects of the proposed project (and project alternatives) on the specific Roosevelt elk herd where increased tags are proposed. The model allows the user to vary carrying capacity to reflect real-world changes in habitat. Population age and sex ratios (observed and estimated) are primary inputs to the model. Elk Pop allows analysis of multiple harvest alternatives simultaneously and is easily adapted to most herd situations.

Elk Pop utilizes data on age and sex composition of the herd, maximum calf survival, estimated population numbers, nonhunting mortality, and hunting mortality. Age and sex composition and maximum calf survival figures used in the model are based on observed and estimated rates. Population level and nonhunting mortality rates were estimated. Estimates of nonhunting mortality rates were considered valid representations of actual nonhunting mortality rates when the model predicted the observed herd composition ratios for 10 consecutive years. Effects of various harvest scenarios were then predicted on the basis of composition ratios and estimated nonhunting mortality rates. The computer model runs for various harvest scenarios (proposed project and the alternatives) for the Northwestern elk zone can be found in Appendix 3.

2. Changes in tag quotas for other hunting zones in the state

Proposed changes to tag quotas in other hunting zones in the state fall within the tag quota ranges that were analyzed within the 2010 Environmental Document. The analysis in this SED focuses on any new significant or substantially more severe

environmental effects from increasing the tag quota ranges in the Northwestern Elk Zone. There are no anticipated significant or substantially more severe environmental effects for the other hunting zones than were previously evaluated in the 2010 document.

BACKGROUND AND EXISTING CONDITIONS

THE MANAGEMENT OF ELK IN CALIFORNIA

There are three subspecies of elk in California: Roosevelt, Rocky Mountain, and tule elk. Roosevelt elk occupied the Cascade and Coast mountain ranges as far south as San Francisco (Harper et al. 1967), and eastward at least to Mount Shasta (Murie 1951). Tule elk were distributed throughout the Central, Sacramento and San Joaquin valleys and the grasslands and woodlands of central California's Coast Range (McCullough 1969). Although there appears to be disagreement regarding their subspecific status, both Murie (1951) and McCullough (1969) included portions of Shasta, Siskiyou and Modoc counties in northeastern California within the historical range of Rocky Mountain elk. Further clarification of the historical and current subspecific status of elk in northeastern California is unlikely because of the translocation of Rocky Mountain elk to the Pit River area in the early 1900s. However, predictions of genetic flow across the landscape supported by the journal entries of early American explorers suggest that elk have been endemic to northeastern California for thousands of years. Locations where historical specimens of Rocky Mountain elk have been recovered have helped scientists map the probable routes taken by these highly mobile ungulates as they populated North America (McCullough 1969).

Because of their large body size and the availability of smaller prey, it is unlikely that Native Americans had a significant impact on elk populations in California. Early explorers also had little direct impact on elk populations. Apparently they preferred domestic livestock to elk (McCullough 1969). However, these early explorers were responsible for the introduction of exotic annual grasses and domestic livestock, both of which had long-term, deleterious impacts on California's elk populations. Livestock competed directly with elk for forage and contributed to the conversion of the native perennial grasslands to annual grasslands, which resulted in the loss of important forage plants used by elk during the summer and fall months.

Historical Perspective of Roosevelt Elk Management

Although once widely distributed throughout northern California, by the late 1800s, Roosevelt elk were extirpated throughout much of their historic California range. Barnes (1925a, 1925b) reported that by 1925, Roosevelt elk range in California was reduced to one small area in Humboldt and Del Norte counties. Mining, logging, agriculture, and market shooting were factors that contributed to the decimation of Roosevelt elk in much of California. Because of their large body size and herding behavior, elk were vulnerable to market shooting. Harper et al. (1967) discussed the

historical distribution of Roosevelt elk in California and reported that by 1967 the population was increasing in size and in no danger of extinction.

Based on the current distribution of Roosevelt elk in California (Appendix 4), population growth and range expansion has continued since 1967. Through U.S. Forest Service and Bureau of Land Management district planning, habitat management efforts have resulted in significant Roosevelt elk population increases during the 20th century. Roosevelt elk herds in California are now healthy and viable. Populations of Roosevelt elk currently exist in the coastal areas of Mendocino, Humboldt, and Del Norte counties, in addition to the Cascade and Klamath mountain ranges in 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. Other populations were established when elk moved into California from Oregon. Additionally, new populations have become established through the dispersal of elk from existing populations to adjacent suitable areas. The Department currently estimates the statewide Roosevelt elk population at approximately 5,700 individuals. This estimate is based on field observations, and professional judgment and experience obtained in studying elk throughout California. The Department has determined this estimate of total population size is reasonable.

Roosevelt elk use forested habitat types, where they are often impossible to see from a helicopter because of the dense forest canopy. For this reason, helicopter-assisted capturing of Roosevelt elk is generally not effective in California. Nevertheless, successful Roosevelt elk translocations have occurred when large groups have been captured in Redwood National Park or on winter range in Oregon. Since 1985, the Department has translocated more than 280 Roosevelt elk to reestablish populations in portions of southern Humboldt, Mendocino, Siskiyou, and Trinity counties.

Existing conditions regarding elk hunting

Regulated public hunting for Roosevelt elk has occurred annually in California since 1986, whereas annual hunting for Rocky Mountain elk began in 1987. Public tule elk hunting has been authorized by the Commission annually since 1989. Additional public hunts for Roosevelt, Rocky Mountain and tule elk have been established subsequent to 1986, and annual elk hunting began within portions of the Northwestern Unit in 1993. Appendix 5 lists the verbatim for the current elk hunting regulations in California.

PLM Hunts (Section 601, Title 14, CCR)

The PLM Program was authorized by the Legislature to protect and improve wildlife habitat by encouraging private landowners to manage their property to benefit fish and wildlife. Economic incentives are provided to landowners through biologically sound yet flexible seasons for game species, resulting in high-quality hunting opportunities which may be marketed by the landowner in the form of fee hunting and other forms of recreation. Section 601, Title 14, CCR, contains regulations adopted by the

Commission pertaining to the program, and sections 3400-3409, FGC, contain the subject statutes.

Landowners have the right to charge access fees for hunting, fishing, and other recreation on their property. The Department carefully reviews each plan to ensure that required habitat improvement efforts benefit many species of wildlife and that harvest strategies comply with accepted goals and objectives for management of the game species involved. The PLM Program further allows the Commission to authorize hunting and fishing seasons and bag limits specific to licensed PLM areas pursuant to approved management plans.

The PLM Program currently is an element of the Department's elk management program. During 2018, nine landowners offered opportunities to hunt Roosevelt elk through the PLM Program in Del Norte and Humboldt counties. The proposed project does not involve increasing elk tags in the PLM Program (Appendix 6).

Cooperative Elk Hunting Area hunts (Section 555, Title 14, CCR)

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 (Appendix 7 - Section 555, Title 14, CCR). In 2018, three Cooperative Elk Hunting Area elk tags were issued in the Northwestern elk zone.

POLICY CONSIDERATIONS

The Legislature formulates laws and policies regulating the management of fish and wildlife in California. The general wildlife conservation policy of the State is to encourage the conservation and maintenance of wildlife resources under the jurisdiction and influence of the State (Section 1801, FGC). The policy includes several objectives, as follows:

1. To provide for the beneficial use and enjoyment of wildlife by all citizens of the State;
2. To perpetuate all species of wildlife for their intrinsic and ecological values, as well as for their direct benefits to man;
3. To provide for aesthetic, educational, and non-appropriative uses of the various wildlife species;
4. To maintain diversified recreational uses of wildlife, including 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;
5. 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 resource;

6. To alleviate economic losses or public health and safety problems caused by wildlife; and
7. To maintain sufficient populations of all species of wildlife and the habitat necessary to achieve the above-stated objectives.

GLOBAL CLIMATE CHANGE

Climate changes caused by increasing atmospheric concentrations of greenhouse gases are expected to result in marked changes in climate throughout the world (deVos, and McKinney, 2007). Although many wildlife habitats in North America have become progressively warmer and drier in the last 12,000 years, the greatest rate of change has occurred during the last 150 years (Fredrickson et al. 1998). Predicted changes due to continued warming include increased frequency and severity of wildfires, increased frequency of extreme weather events, regional variation in precipitation, northward and upward shifts in vegetative communities, and replacements of biotic communities. These changes are expected to affect abundance, distribution, and structure of animal and vegetative communities.

Local and specific regional changes in climate and associated changes in vegetative communities will be the determining factors regarding the distribution and abundance of elk in California. Although research specific to elk responses to climate change is limited, what information does exist indicates that both adverse and beneficial effects - depending on a variety of local/regional factors such as latitude, elevation, topography, and aspect – can be expected to result. For example, in the Rocky Mountain National Park where snow accumulation currently limits elk winter range, computer simulations suggest a reduction in future snow accumulations of up to 25-40%. An expansion of winter range would serve to increase over-winter survival and recruitment of juveniles into the adult population, leading to an increase of the overall elk population in that area (Hobbs et al. 2006). Conversely, research in Banff National Park, Canada indicates climate change will result in colder winter temperatures, increased snowfall, and a higher frequency of winter storms (Hebblewhite 2005). These factors would result in a decrease in over-winter survival and recruitment, leading to an overall reduction of the elk population for that area.

Hunting seasons and tag quotas are proposed to the Commission who has the authority for adopting regulations on an annual basis. These seasons and quotas are based on annual population and harvest data, annual population model results, and area-specific population/harvest objectives. Although the impact of climate change on California's elk population is difficult to predict and warrants continued study, the Department and the Commission have the ability to quickly respond to population fluctuations (positive or negative) by increasing or decreasing hunter opportunity in accordance with current and future management objectives for this species. However, reducing one mortality factor

(sport hunting) will not alone mitigate for impacts associated with global climate change; the ability to manage and provide adequate amounts of required habitats is the ultimate deciding factor in wildlife populations.

POTENTIAL FOR SIGNIFICANT EFFECTS

The Commission has determined the proposed project will not have any long-term significant impact on the environment. The analysis included here and discussed below addresses the potential for significant effects on the gene pool, impacts on social structure, effects on habitat, effects on recreational opportunities, effects on other wildlife species, effects on public safety, growth inducing impacts, short-term uses and long term productivity, significant irreversible environmental changes, welfare to the individual animal, and cumulative impacts. Although not a resource category where CEQA requires analysis, for informational value the Commission has also analyzed the potential for effects on economics from the proposed project. Each of these areas are discussed in more detail below.

The proposed project allows an increase in already limited public hunting of Roosevelt elk in portions of Del Norte and Humboldt counties. In 2018, 88 elk tags were issued in Del Norte and Humboldt through the General Draw, PLM, SHARE and the Cooperative Elk Hunting Program. Table 2 shows the 2018 harvest including PLM, SHARE, and Cooperative Elk Hunting. The proposed project will result in increasing the total tags to allow removal of up to 108 Roosevelt elk.

Table 2. 2018 Northwestern Elk Zone Total Tags and Reported Harvest
(Includes General, SHARE, Cooperative, and PLM)

2018 Elk Tags Issued					
	Issued			**Harvested**	
	Bull	**Antlerless**	**Either-sex**	**Bull**	**Antlerless**
General	15	0	3	18	0
PLM	21	19	0	19	16
SHARE	5	22	0	5	19
Cooperative	3	0	0	3	0
Totals	**44**	**41**	**3**	**45**	**35**

Elk hunting will result in the death of individual animals. The removal of individual animals from selected herds, which are relatively large and healthy, will not significantly reduce herd size on a long-term basis. Production and survival of young animals within each herd will replace the animals removed by hunting (Fowler 1985, Racine et al. 1988). Analysis of current levels of take is contained in the 2010 Environmental Document, and found to have no significant impact for all levels of take within the analyzed quota range. Since the changes proposed in this project will only increase public elk hunting in one of the State's elk hunt zones, removal of individuals will have little influence on the statewide elk population. Therefore, the proposed action of

increasing the tag quotas by 20 removing no more than approximately 68 elk by public hunting (general, SHARE, and Cooperative hunts) and 40 elk through the PLM Program will not have a significant adverse impact on either local or statewide elk populations. The Department does not anticipate issuing up to the maximum number of tags in most hunt zones but the Commission has assumed the maximum level of take in its analysis of the potential impact under the proposed project.

As discussed in more detail below, the Commission has concluded the proposed project will not have a significant adverse effect on the environment. No mitigation measures for the proposed project or alternatives are necessary.

Methodology

A computer model which simulates herd performance (Smith and Updike 1987) was used to assess effects of the proposed action and alternatives (Appendix 3) on the elk hunt zones where a tag change is proposed.

A variety of natural and human-induced factors combine to affect the status of a wildlife population. Natural factors affecting elk populations include, but are not limited to, such things as predation, starvation, disease, and parasitism. Environmental factors (e.g., precipitation) can affect food quantity and quality, thereby affecting elk populations. Theoretically, competition among members of the same species and between different species (e.g., deer, elk) also can affect elk populations. Catastrophic events (e.g., wildfires) can affect localized populations on a short-term basis. Human-induced factors, such as urbanization and agricultural development, also affect elk populations. Hunting can affect a population in various ways, depending on the intensity and level of harvest.

Modern wildlife management uses models to analyze, understand, and predict the outcomes and complex interactions of the natural environment. Like many other technical fields that affect society, such as chemical engineering, aerospace technology, and climatology, the science of wildlife management has found that the use of models is invaluable for predicting the effects of human-induced and natural events on wildlife and their habitat.

Population models can range from simple word models (the statement "elk are born, grow up, reproduce and die" is a grossly simple word model of a population process) to highly complex and sophisticated mathematical abstractions. Some models are empirical (that is, based on observed data), and others are theoretical. Many models are useful in helping to frame conceptualizations of population processes, resulting in testable predictions about the subject at hand. Nevertheless, the goal of a model is to aid in analyzing known facts and relationships that would be too cumbersome or time consuming to analyze manually. Some of these models describe specific systems in a very detailed way, and others deal with general questions in a relatively abstract fashion. All share the common purpose of helping to construct a broad framework

within which to assemble an otherwise complex mass of field and laboratory observations. Though we often think of models in terms of equations and computers, they can be defined more generally as any physical or abstract concepts of the structure and function of "real systems" or natural occurrences.

Key in the development and use of any model is its reliability. The models used in this document have been developed based on field observation, published literature, and/or expert opinion. They have been tested against known results and are consistent.

Compensatory Response

The Stock-Recruitment model (Ricker 1954, McCullough 1984) is useful for conceptualizing compensatory mechanisms and density-dependent responses that are believed to occur in wildlife populations. This model shows population responses to changes in density in terms of net recruitment (i.e., the survival of calves). It has the advantage of not requiring assumptions about internal birth and death rates, and it can be empirical.

The fundamental assumption of the Stock-Recruitment model is that calf survival is a function of population density and decreases as density increases (the converse is also true). There is a large body of evidence indicating that this is the case among populations of elk (McCullough 1979, Clutton-Brock et al. 1982). Thus, density can be measured in either absolute or relative terms, and with net recruitment one can begin to build a model that will allow predictions of the population's response to changes in density.

At a low population size, even with a high recruitment rate, few new individuals enter the population, but their survival is higher. As population size increases, so does the number of recruits, up to a certain level. The rate of recruitment decreases as a result of reduced survival of young. The degree of elk harvest necessary to achieve maximum sustained yield (MSY) can be expected to result in low population densities. Objectives to maximize residual population size and MSY are necessarily mutually exclusive. This has important implications for harvest management, as harvesting to achieve MSY suppresses the total population below its maximum potential. Spring population size (after calves are born) is thus below the carrying capacity of the range (McCullough 1984).

At high densities, the pre-mortality population will temporarily exceed carrying capacity (if an area is at carrying capacity – few of California’s elk populations are believed to be at carrying capacity), resulting in possible habitat damage. When population sizes are at or near the range carrying capacity, yield will be low (proportionately), because recruitment of calves is low relative to herds at lower density. In such cases, increases in harvest result in increased net recruitment, and the population will stabilize at a new population size if the new harvest level remains fixed (McCullough 1984).

Elk Pop (Smith and Updike 1987) is a microcomputer-based model which was developed by the Department for the purpose of analyzing harvest alternatives. Elk Pop was used to assess effects of the proposed project (and project alternatives) on the specific Roosevelt elk herds where hunting is proposed. The model allows the user to vary carrying capacity to reflect real-world changes in habitat capability. Observed population age and sex ratios are primary input to the model. Elk Pop allows analysis of multiple harvest alternatives simultaneously and is easily adapted to most herd situations.

Elk Pop utilizes data on age and sex composition of the herd, maximum calf survival, estimated population numbers, nonhunting mortality, and hunting mortality. Age and sex composition and maximum calf survival figures used in the model are based on actual observed rates. Population level and nonhunting mortality rates were estimated. Estimates of nonhunting mortality rates were considered valid representations of actual nonhunting mortality rates when the model predicted the observed herd composition ratios for 10 consecutive years. Effects of various harvest scenarios were then predicted on the basis of observed composition ratios and estimated nonhunting mortality rates. The computer model runs for various harvest scenarios (proposed project and the alternatives) for each elk herd where hunting is proposed can be found in Appendix 3.

IMPACTS OF HUNTING ON ELK POPULATIONS

Elk hunting will result in the death of individual animals. The removal of individual animals from selected herds which are relatively large and healthy will not significantly reduce herd size on a long-term basis. Production and survival of young animals within each herd will replace the animals removed by hunting (Fowler 1985, Racine et al. 1988). Analysis of current levels of take, as well as the proposed levels of take for hunt zones statewide is contained in the 2010 Environmental Document, and found to have no significant impact for all levels of take within the analyzed quota range. Since the changes proposed in this project will only increase public elk hunting in one of the State's elk hunt zones, removal of individuals will have little influence on the statewide elk population. Therefore, the proposed action of increasing the tag quotas by 20 (removing no more than approximately 68 elk by public hunting (general, SHARE, and Cooperative hunts) and removing no more than 40 elk through the PLM Program will not have a significant adverse impact on either local or statewide elk populations.

Numbers of elk harvested by hunters in the PLM, public and Cooperative Elk Hunting programs in Del Norte and Humboldt counties during 2018 are reported in Table 2.

Northwestern Roosevelt Elk Herds (Del Norte and Humboldt)

The proposed project for the Northwestern zone could result in an increase in 20 elk being harvested (for a maximum of 108) including, General, PLM, SHARE, and Cooperative elk tags. Computer simulation runs of this harvest scenario predict

population numbers would increase (Appendix 3), based on the current conservative population estimate of 1,600 elk. The bull-to-cow ratio would remain stable, while the calf-to-cow ratio would increase.

The Commission, based on information provided by the Department, does not anticipate this proposed harvest scenario will result in adverse impacts to the Northwestern Roosevelt elk herd. Since 2016, the Department has been working towards implementation of systematic elk surveys in this zone. While development and implementation of those surveys to improve population assessments are ongoing, initial counts suggest a healthy and growing population. Direct counts within a portion of the zone from 2016 to 2017 resulted in a minimum count of 990 elk in 22 distinct groups (CDFW 2018). Over the past two years, efforts looking at movements of GPS collared elk, composition counts, and calf survival suggest a ten percent increase in the total number of elk in portions of the Northwestern elk hunt zone. In addition, the calf:cow ratio has been stable at 32 and 34 calves to 100 cows, and the bull:cow ratio has increased from 21 to 31 bulls to 100 cows. Within this portion of the zone, consisting of primarily private lands where conflicts and property damage continue to increase, the Department collared 58 calves from 2017 to 2018 to investigate calf survival. Initial analysis suggests juvenile survival was high, and when combined with the increase in observed count data, and the high calf:cow ratio, it indicates a growing population.

Allocation of tags through the SHARE program to focus recreational harvest in certain areas can help alleviate landowner conflicts, and the harvest in recent years has occurred primarily in these areas of the hunt zone. Increasing population trends suggest the population can sustain the proposed level of hunting and continue to grow. Through landowner cooperation, the SHARE program results in harvest totaling up to nearly half the total general tags available. As currently designed, the SHARE program allows focused elk harvest restricted to specific ranches or farms rather than across the entire hunt zone.

To simulate effects of the proposed quota increase for Northwestern California, the Department, using the minimum count of 990 from only a portion of the entire zone, conservatively assumes the current population size is 1,600 elk and carrying capacity is estimated at 1,760 elk across the entire zone. Elk populations are growing and expanding within the unit and both current population size and biological carrying capacity are likely much larger than these respective estimates.

Other Hunting Zones Statewide

The levels of take for all other hunting zones statewide are analyzed in the 2010 Environmental Document. The Commission finds there are no new significant or substantially more severe environmental effects than were previously evaluated in that document, and were determined to be insignificant.

IMPACTS ON THE GENE POOL

The Department estimates there are a minimum of 5,700 Roosevelt elk distributed throughout several areas of northern California. The proposed project would allow an increased statewide take of 20 Roosevelt elk (for total statewide take of approximately 318 Roosevelt elk). Assuming a condition where all tagholders are successful, this would result in a short-term reduction of approximately six percent of the statewide Roosevelt elk population. This does not constitute a significant impact to the statewide gene pool and is well within the population's ability to maintain or increase size over the long term.

It is expected that not more than 255 elk (Rocky Mountain, Roosevelt, and Tule elk combined) will be taken by hunters under the PLM Program during 2019. This constitutes just over two percent of the statewide elk population and is well within the population's ability to maintain or increase size over the long term. Any population reduction from the PLM Program would be short term and would not constitute a significant impact to the gene pool.

The ability of elk populations to experience a given level of hunting mortality without a reduction in health or viability is described by Savidge and Ziesenis (1980) as sustained-yield management. Sustained-yield management is closely related to the compensatory responses in reproduction discussed previously.

Elk hunting in California currently involves herds at separate locations in the State that are at or above herd management objectives. Because the proposed project will not significantly reduce statewide population levels, the Commission concludes that there will not be an adverse impact to the gene pool, either locally or statewide.

IMPACTS ON SOCIAL STRUCTURE

Elk are gregarious and tend to form groups or aggregates. Elk do not mate for life. Males do not invest time or energy in the care of young, but generally form separate bachelor groups. Except for a short breeding period, most adult males generally remain separate from cow-calf groups during the remainder of the year. Therefore, removal of bulls by hunting will have a minimal effect on the social structure of the populations, provided that minimum herd objective bull ratios are maintained. Proposed harvest levels for each herd have been established to maintain or exceed minimum herd objective bull ratios and to provide for genetic variability, fertilization of cows, and public viewing opportunities of bull elk.

During the nonbreeding period, cow-calf groups generally contain few, if any, adult bulls. However, immature bulls are tolerated in cow-calf groups (Geist 1982). Newborn calves are initially completely dependent upon their dams but quickly adjust to the cow-calf group and form nursery groups within the larger group. Nursery groups briefly fixate and respond to a succession of adult females (Geist 1982). During the first 2.5 months of life, calves nurse extensively (Bubenik 1982). Nursing declines by August

for most elk in California, when the proposed project would begin in some areas. There is no indication that calves orphaned at this time have been severely impacted; at Grizzly Island, tule elk calves orphaned in August remained within the social structure of the groups.

Generally, the proposed project has the potential to increase the ratio and number of calves in the hunted elk populations. The increase in calf survival results in a shift of age structure of the elk population from older to prime-age individuals (five to seven years). These prime-age individuals tend to provide higher recruitment rates (calf survival) for the population (Hines et al. 1985). Historical data (Fowler 1985, Botti and Koch 1988, Racine et al. 1988), computer simulation modeling (Smith and Updike 1987), and information from the literature (Taber et al. 1982) indicate that the removal of elk from the population (due to hunting, trapping for reintroduction, or high winter mortality) in one year results in a larger number of calves recruited into the population the following year.

Computer simulation modeling of the populations proposed to be hunted indicates that the removal of elk from these populations by hunting (in addition to nonhunting mortalities) will result in an increased survival of calves born the following spring for most areas (Appendix 3). As an example, in August of 1980 the observed calf ratio for the Bishop subherd was 20 calves per 100 cows. In December of 1980, the Department relocated 75 elk from the Bishop subherd. The following August (1981), the observed calf ratio was 43 calves per 100 cows. This type of increased calf survival (recruitment) is expected and has been observed numerous times in the Owens Valley (Racine et al. 1988) and at Grizzly Island (Botti and Koch 1988).

Most western states establish a goal for a post hunt ratio of at least 20 bulls per 100 cows (the proportion of bulls to cows in the population). Some states have goals as low as six bulls per 100 cows, while other states have goals of 25 bulls per 100 cows in trophy hunt areas (Mohler and Toweill 1982). The Department's management objective for most hunted populations is to maintain at least 25 bulls per 100 cows (the objective ratio for the Northwestern Unit is 15 bulls per 100 cows).

Most tag quotas provide for take of both male and female elk. Achieving and/or maintaining herd objective bull-to-cow ratios is accomplished most readily by harvest of both sexes, because harvesting only male elk can skew the sex ratio towards females; and, conversely, harvesting only female elk can result in a population skewed towards males (Mohler and Toweill 1982).

Based on the computer simulation analysis of expected harvest rates, the post-hunt bull-to-cow ratios are expected to increase and/or remain above the Department's management objective. Additionally, computer simulation modeling indicates that the proposed take is within sustained-yield management levels. That is, under the proposed harvest levels, the population will be able to maintain itself over the long term at existing or higher population levels.

As discussed earlier, female pregnancy rates and calf survival are inversely related to the density of the elk herd in relationship to the condition of the available habitat. Management that provides for frequent reductions in female and young of the year elk in areas where elk have exceeded their herd size objective encourages age structure dominated by reproductively successful females (Hines et al. 1985).

Based on computer simulation modeling, the proposed project has the potential to increase calf survival rates for the hunted herds, resulting in improved general health of the hunted populations. Also, computer simulation modeling predicts minimal changes in bull-to-cow ratios as a result of the proposed project; such ratios for most hunted herds are predicted to increase or remain near the minimum objective ratio. Bull-to-cow ratios are predicted to remain significantly above corresponding ratios for other western states with hunting programs. Thus, it is unlikely that adverse impacts to the social structure of hunted herds will occur as a result of the proposed project. By increasing calf-to-cow ratios, the proposed project would improve herd condition and could thus have a positive effect on herd social structure.

EFFECTS ON HABITAT

The removal an additional 20 Roosevelt elk through public hunting is not expected to significantly change elk population levels on a long term basis. If no major changes occur in the elk population levels, no major changes in elk-caused effects on habitat (e.g., elk foraging pressure on plants) would be expected. Therefore, the proposed project is not expected to have an impact on habitat in the hunt areas.

The typical technique used to hunt elk within the proposed hunt areas involves spotting animals at a distance and/or quietly approaching them on foot to within a reasonable shooting range. Hunting from a motorized vehicle is illegal. Some hunters may use horses to cover greater distances searching for elk. In any case, the relatively low intensity of hunting effort (because of the low number of elk hunters in the field) within these areas is not expected to produce major effects on habitat. The increase in tags proposed by the Commission is not expected to cause any large increase in activity, or any additional significant impacts.

Both public and private lands occur within the hunt areas. On public lands, the Department provides input to the USFS regarding actions to improve the condition of elk herds and their habitat. Further, the USFS is mandated to incorporate wildlife needs, including elk, into their planning process, as required by the National Forest Management Act. In general, current timber harvest practices on public land benefit elk by creating a diverse mosaic of early successional and mature forest habitat types. Most of the public lands proposed to be open to elk hunting within Del Norte and Humboldt counties are currently open to the public on a year-round basis. These lands also are used for other outdoor recreational activities, such as fishing, photography, hiking, hunting, bird watching and general nature viewing. Due to the large size of the

hunt areas (each area is several hundred square miles in size) and existing human use levels of the hunt areas, it is unlikely that the harvest of an additional 20 elk will individually or cumulatively negatively impact the habitat in the hunt areas.

EFFECTS ON RECREATIONAL OPPORTUNITIES

Hunting Opportunities

The proposed project continues to authorize public hunting of Roosevelt elk providing opportunities to harvest up to 108 elk by hunters who will participate in this unique outdoor experience. The demand for elk hunting opportunities is extremely high in California. In 2018, 39,829 individuals applied for an opportunity to hunt elk in California. In 1988, for the first time, a nonrefundable fee of $5 was charged to apply for an elk hunt. Despite the new fee, almost 10,000 licensed hunters applied for elk license tags in 1988 with the number growing almost every year to date. The proposed project benefits the hunting public by providing hunting opportunities consistent with the State's Wildlife Conservation Policy and FGC sections 332 and 1801.

The season dates for the Northwestern elk hunts coincide, at least partially, with the B-1 and B-4 deer seasons. However, it is unlikely that deer hunters will be adversely impacted by the low number of elk hunters that may be in the field during the deer season. The Northwestern season dates will also coincide with bear season and the year round wild pig season. Due to the large areas open to hunting and the relatively short elk season, elk hunters will not affect the success or quality of experience for hunters of other species of wildlife.

Some individuals have expressed concern that the hunting regulations of other states might have adverse effects on elk hunting in California (presumably by causing an influx or exodus of hunters.) For the most part, non-resident public elk hunting opportunities on California are very limited (only up to one elk tag per year is available for non-residents to draw; non-residents may purchase one of the three fund-raising elk tags, and are eligible to purchase elk tags through the PLM Program). The Commission does not expect that the hunting regulations of other states will have an adverse effect on elk hunting in California.

Nonhunting Opportunities

Non-hunting users of the elk resource (viewing, nature study, and photography) will not be significantly impacted by the take of an additional 20 elk from the Northwestern Hunting Zone. Nor will the proposed project impair non-hunters' ability to enjoy the outdoors, the elk resource, or its habitat, due to the availability of opportunities to view elk herds in areas where hunting does not occur, such as within federal or state parks. Three of the State's 22 tule elk herds are maintained in a penned situation where no hunting is contemplated. These herds provide the public an opportunity to enjoy tule elk in their native habitat. Additionally, the proposed action does not provide hunting

opportunities at Point Reyes National Seashore, which has a large population of tule elk and is accessible to the public for the enjoyment of elk and other wildlife in the area. General elk hunting seasons vary from four to 23 days. Based on hunter tag returns from 2018, elk hunters only spend, on average, four days hunting elk. This indicates that even for those hunted herds, a majority of time can be spent viewing elk without hunters in the field.

The proposed action will not impact the non-hunting public, because the number of hunters in the field at any one time (established by the quotas for each hunt), in conjunction with the areas open to hunting, will result in very low hunter density. Historically, all areas open for hunting have been open for other types of hunting (waterfowl, upland game birds, rabbit, wild pigs, black bear, etc.) during the same timeframe as the proposed elk hunts. For non-hunters concerned about being in the field during proposed elk hunts, large areas of similar habitats adjacent to or near all hunt areas may be used for non-hunting activities during the short elk hunting period.

EFFECTS ON OTHER WILDLIFE SPECIES

Although some overlap of food habits exists, competition between deer and elk has not been a documented problem in California. Nelson and Leege (1982) stated, "It would appear, therefore, that neither the elk nor the mule deer is affected seriously by the other, mainly because of differences in primary forage species and habitat choice." This also appears to be the case in California. Potential for competition between elk and deer can exist on critical winter ranges shared by the two species. However, there is no scientific evidence to indicate that removal of elk through a hunting program will adversely impact the local or statewide deer resource.

During the last few years, the potential for competition between deer and elk has received greater attention in the western states and provinces of North America. Many states and provinces have reported a decline in deer population numbers, coinciding with an increase in elk numbers. It has not been proven that elk displace deer or are a significant factor in suppressing their numbers throughout a broad geographic region. In considering the potential for competitive interaction between deer and elk, a variety of factors may be important, such as predation, climate, digestive physiology, energetics, vegetation succession, livestock, and human-related factors. Lindzey et al. (1997) discussed these and other factors in reviewing the potential for competition between deer and elk throughout the west, and compiled an extensive list of references regarding this subject. They concluded it is appropriate to question whether the growth of elk populations has contributed to apparent deer decline, but found no consistent trends in geographic areas used sympatrically to suggest a cause-and effect relationship.

Due to their large body size, adult elk experience limited predation. Cases of lion predation on adult elk have been documented (Taber et al. 1982, Booth et al. 1988, Racine et al. 1988). Results of fall surveys have documented several confirmed lion-

killed elk since 1988. However, there is no scientific evidence to indicate mountain lion predation significantly affects elk statewide in California as demonstrated by increases in elk numbers.

Coyotes, black bears, wolves, and mountain lions prey on elk and/or elk calves. It is possible, as a result of removing adult elk from elk herds, calf production will increase the following spring. This could provide additional prey for predators. Historical herd performance data collected on elk herds indicate that calf recruitment will increase after an elk removal, regardless of the existence of predators in the area (Racine et al. 1988). Based on a review of available information discussed in this document, it is reasonable to assume the proposed project will not have measurable short-term or long-term effects on other local wildlife populations, including deer, mountain lions, black bears, wolves, and coyotes.

A number of endangered, threatened or locally unique animals and plants may occur within the elk hunt areas. The Department is charged with the responsibility to determine if any hunting regulations will impact threatened or endangered species. It complies with this mandate by consulting internally and with the Commission when establishing elk hunting regulations to ensure that the implementation of the proposed project and existing hunting regulations do not affect these species. It is unlikely that adverse impacts to rare, endangered, threatened, or locally unique species associated with the proposed hunt areas will occur as a result of the proposed project. Most rare, endangered, threatened, or locally unique species associated with the hunt areas either are associated with habitats where elk hunting is not likely to occur or use these areas during a time (season) different from when the proposed project will occur. The proposed project will involve a minimal number of hunters using areas, that for the most part, are open to the public for a variety of uses, including hunting. The Department has concluded that, based on conditions of the proposed project and existing hunting regulations, differences in size, coloration, distribution, and habitat use between the listed species and elk, the proposed project will not jeopardize these species.

EFFECTS ON ECONOMICS

The proposed project will not result in changes to the environment, either directly or indirectly, which would produce significant negative environmental effects. Therefore, no CEQA review of economic effects is necessary. However, the proposed project has the potential to result in minor economic effects on the communities where elk hunting is proposed.

The effects of the Elk hunting regulations on the local economy may involve increases in economic activity near the hunt areas, as visiting hunters purchase goods and services from local merchants. This additional spending would generate additional retail sales, business spending, and income that could in turn, contribute to employment in motels, restaurants, and retail stores.

EFFECTS ON PUBLIC SAFETY

Since 1989, the Department has received no reports of elk hunting-related casualties in California. This does not diminish the fact that people have died or been wounded while hunting other big game animals. Based on the total number of licensed hunters in California and the annual number of accidents, there is roughly a 0.00425-0.005 percent chance of being killed or wounded while hunting deer. Additionally, Department records show that no non-hunting injuries or deaths have occurred as a result of elk hunting. As with any outdoor activity, there is always a risk of injury or death. However, the probability of being injured while hunting elk is extremely low, especially in comparison to other recreational activities. This good safety record is due, in part, to the requirement that all hunters must successfully pass a hunter safety education course prior to receiving a hunting license. It is unlikely that the proposed project will result in adverse impacts to public safety.

GROWTH-INDUCING IMPACTS

There are no growth-inducing impacts associated with the proposed project. As discussed in "Effects on Economics" in this chapter, minor increases in retail sales, income, and possibly employment are anticipated in the regions where the proposed hunt areas exist. However, the small number of public tags available is unlikely to create growth-inducing impacts in a State with a total human population of over 30 million.

SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The proposed project will not affect a variety of short-term uses currently available to the public. Additionally, the proposed project will provide for public hunting opportunity without adversely affecting long-term productivity of statewide or local elk populations, based on predictions of simulation modeling.

SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES

No significant irreversible environmental changes are expected to occur as a result of the proposed project. The proposed harvest levels were selected to avoid adversely impacting hunted populations and to reach or maintain herd management objectives. The proposed project is designed to avoid significant adverse impacts to other wildlife species, their habitat, and listed or locally unique species. As discussed previously, adverse impacts to economics and public uses (including safety) are not expected.

WELFARE OF THE INDIVIDUAL ANIMAL

Analysis of welfare of the individual animal was presented on page 120 (incorporated by reference, April, 2006 Final Environmental Document, SCH#2003112075, available at 1812 9th Street, Sacramento, CA 95811). The project has been designed to limit wounding through the specification of minimum performance requirements for archery equipment and firearms. It is expected that some wounding may nevertheless occur. The methods of take are not one hundred percent lethal. Lethality is largely a function of hunter skill and accuracy. The Department has evaluated the welfare of the individual animal and has specified minimum performance requirements for archery equipment and firearms in existing regulations.

CUMULATIVE IMPACTS

The proposed project provides for a specific level of public elk hunting in specified areas during 2019, and it is reasonably foreseeable that the Commission would consider and approve hunts in these areas in the future. Because of this potential, the Department modeled population performance of hunted herds for a 10-year period. Potential effects of cumulative factors identified in this section were considered with the model runs. It must be emphasized that the model runs specify the same level of harvest (expressed as a percentage of the population) each year. The statutorily mandated regulation process involves review and appropriate regulation changes based on the condition of a population. Data collected by the Department during the year following the approval or denial of the proposed project would be examined, and appropriate, biologically sound recommendations would be presented by the Department to the Commission prior to approval of any future hunt.

Section 255, FGC, identifies the steps required for the Commission to adopt, amend or repeal regulations relating to mammal hunting. This law requires that the Commission receive recommendations regarding mammal hunting regulations from Commission members, its staff, the Department, other public agencies, and the public. The process is analogous to the Commission establishing specific harvest quotas for the deer and pronghorn antelope hunting seasons. The system has worked well over time in adjusting the hunting program to maintain healthy wildlife populations.

Effects of Private Lands Wildlife Habitat Enhancement and Management (PLM) Area Program

To become licensed in the PLM Program, landowners are required to submit an application package which includes a management plan. This plan must contain, among other things, habitat enhancement goals and objectives to be accomplished over the term of the five-year license. The habitat projects outlined in the plan are directed toward improving habitat for both game and nongame species. The ultimate goal of these habitat improvement practices is to enhance or stabilize (under adverse ecological conditions) populations of various wildlife species present on the area. Once licensed, the PLM is reviewed annually by the Commission to ensure compliance with all regulations and administrative procedures.

The PLM Program has been successful as an incentive for landowners to protect and improve wildlife habitat. Habitat improvements implemented under approved management plans on licensed areas include conducting controlled burns to improve forage conditions, reducing livestock grazing to reduce competition with wildlife, protecting wildlife fawning/nesting sites and riparian areas, developing wetland/marsh areas, constructing brush piles, improving water sources, and planting forage and cover crops for wildlife. The projects directly benefit deer, elk, bear, antelope, wild pigs, waterfowl, turkeys, quail, and a wide variety of nongame wildlife, including threatened and endangered species. Habitat improvements accomplished specifically for game species (such as riparian improvement, protection, and enhancement) directly benefit hundreds (approximately 331 species in hardwood-dominated habitats) of nongame wildlife species.

The anticipated PLM harvest was modeled as part of the overall (public and PLM) harvest simulation model run (Appendix 3). As discussed previously, no adverse impacts are expected, based on the simulation model runs. The simulation models (Appendix 3) indicate previous harvest levels have been below the maximum sustainable yield. Because the expected harvest under the PLM Program is less than the maximum sustainable yield (harvest), the Department has determined that the PLM Program, together with the proposed project, will not have a significant adverse cumulative effect on elk populations in California.

Nine licensees participated in the PLM Program for elk in the Northwestern elk zone in 2018 (Appendix 6). The Department recommends issuing no more than 40 elk tags through these nine PLM properties for 2019. Previous total elk harvests under the PLM program have been below these levels (35 elk were harvested in 2018 under the PLM program in the Northwestern elk zone). Expected harvest under the PLM program is anticipated to be below the maximum PLM quota. Thus, harvest under the PLM program, either alone, or combined with the proposed public harvest, will not have a significant adverse cumulative effect on statewide or local populations of elk.

Effects of Drought

Drought cycles are part of the ecological system in California and elk are adapted to low water years. Still, multi-year droughts can reduce elk populations on a local scale. Drought conditions can impact elk in a variety of ways including: degraded habitat quality (less vegetation growth) and reduced food production (both natural and agricultural). California has a "Mediterranean climate," meaning that over the long-term, the State receives the bulk of its precipitation during the cool fall and winter months, while warm spring and summer months are generally dry. In other words, California undergoes a "summer drought" each year. However, extreme variation in precipitation occurs in the State on an annual basis. For example, the northwest coast receives a great deal of precipitation, while southern deserts receive very little precipitation. Additionally, topographic features, such as the Sierra Nevada, influence

climate by creating a rain shadow, whereby most of the precipitation falls on the west side of the range, extracting most of the moisture from clouds by the time they reach the east side of the range. The amount of precipitation in California is extremely variable on a geographic basis within a year and extremely variable in any one area among years.

Throughout much of the State, stream courses, natural lakes, ponds, springs, and reservoirs were affected by the recent drought. As far as terrestrial wildlife are concerned, prolonged drought in areas with scarce water, such as in the desert and south coast ranges, may affect production and survival of young for a variety of species in future years. Droughts are cyclic long-term, and all wildlife species and their habitats in California have evolved under conditions of periodic drought (Bakker 1972, Munz and Keck 1973, Oruduff 1974, Burcham 1975, Barbour and Major 1977). Since the 1800s, California has experienced several drought cycles lasting two to five consecutive years (Department of Water Resources 2015). Because of this natural variation in water availability, vegetation communities have evolved and adapted with associated changes in soil moisture (Barbour and Major 1977). Many of California's plant communities (e.g., desert, chaparral, grassland, oak-woodland, etc.) are drought tolerant. However, drought can affect plant species. Growth and vigor of forage plants may be severely reduced during drought, due to reduced germination of annual plants, and reduced growth of shrubs and trees adapted to conserve water. Consequently, the quantity and quality of forage for herbivores is reduced during periods of drought.

While drought effects on vegetation communities can be unpredictable, some studies have been conducted. One study measured acorn production (a primary food of many wildlife species) in five oak species occurring at a site in Monterey County from 1980-89 (Koenig et al. 1991). That study determined that acorn production was highly variable among oak species from year-to-year and that climatic variables generally did not correlate with annual variation in acorn production. The study also indicated that local acorn crop failures may have detrimental effects on local populations. However, total crop failures on a community-wide basis among all species are rare, even during drought years. Similarly, acorn production data from a four-year period in Tehama County (Barrett, unpublished data) indicate that annual production was approximately 60 percent, 20 percent, five percent, and 180 percent, respectively, of the mean annual crop between 1987 and 1990.

Alternatively, in vegetation communities comprised of annual plants, lack of fall germinating rains, or minimal spring rains can preclude germination of forbs and grasses, which are important sources of forage, primarily during the fall, winter, and spring. The seeds lie dormant in the soil until germinating conditions are suitable. Drought may also weaken resistance of plants to disease, fungus, and insect damage, cyclically affecting vegetation.

Hence, during drought, some plant species respond in ways that benefit wildlife (e.g., increased acorn production), while others respond in ways detrimental to wildlife (e.g., reduced grass and forb growth).

Native game mammals in California have evolved to withstand both drought and flood extremes within their ranges. Before human intervention, these ranges likely varied in response to periods of prolonged drought or wet conditions. Currently, however, remaining habitats are, to a large extent, managed and affected by humans. Water management has likely resulted in greater stability in modern wildlife populations in many cases due, in part, to the advent of water wells, sites developed to enhance water for wildlife (e.g., guzzlers), irrigation, and reservoirs. In many areas, water is more available to wildlife, regardless of drought, than it would have been prior to large-scale human development in California.

The reduced quantity of vegetative cover due to prolonged drought in some areas could affect thermal and hiding cover important to wildlife. However, such effects are not yet reflected in population data.

Significant impacts to wildlife due to drought in some areas of the State may occur if drought conditions persist for more than several years. Potential impacts include reduced habitat quality and quantity, resulting in reduced reproductive success and survival of individuals in a population. As a result, periodic drought conditions may produce short-term effects due to less available forage, but may have little, if any, long-term effects on the abundance of most species.

Effects of drought on wildlife species would be reflected in poorer physical condition of individual animals, decreased survival of individuals, declining reproduction and survival of young, and reduced population size. While fluctuations may occur annually in some areas, the large-scale effects of significant drought events could be felt statewide.

Effects of drought conditions on elk populations have been recorded in the Owens Valley and in the Cache Creek area (Fowler 1985, Booth et al. 1988, Racine et al. 1988). While drought may result in increased mortality among individuals in an elk population (primarily reduced calf survival), the proposed project is based on data collected on populations with exposure to periodic drought conditions and will not affect viability of local populations. Records of drought prior to 1988 indicate the Grizzly Island tule elk herd was not affected (Botti and Koch 1988). Based on the above information the possibility of drought impairing the statewide tule elk population is very unlikely.

The Department’s evaluation of conditions and trends of elk herds and habitats is an ongoing facet of the Department's elk management program (CDFW 2018). Information collected by the Department and other sources will inform future recommendations for elk hunting programs and other management activities, such as habitat improvement or acquisition projects. The impacts, if any, of a catastrophic event on elk populations would be addressed in carrying out any future management actions. In addition, the Commission has the regulatory authority (Section 314, FGC) to take emergency action to cancel or suspend one or more proposed elk hunts if a

catastrophic event occurred which, in conjunction with a hunting program, could significantly impact the elk population. Thus, the Commission does not anticipate adverse impacts will occur as a result of drought in combination with the proposed project.

Effects of Wildfire

One aspect of prolonged drought that would affect wildlife habitat is an increased risk of wildfire due to extremely dry conditions. However, wildfire can be a problem in extremely wet years due to increased fuel loads. Consequently, it can be difficult to conclude that drought years predispose some vegetation communities to wildfire more than wet years. In forested communities, woody plant communities affected by prolonged drought may experience increased plant mortality and decreased moisture content, increasing their susceptibility to wildfire.

Catastrophic events, such as wildfire and drought, have affected elk throughout their evolution. Although effects of drought and wildfire can have an impact on local populations of elk, historical data collected by the Department (McCullough 1969, Fowler 1985, Racine et al. 1988) indicate that there is no evidence that drought, wildfires, or other catastrophic events have resulted in the extirpation of an elk population.

Wildfires are a natural occurrence in elk range. Plant species in the hunt areas have evolved with fire, and many species of plants require fire to complete their life cycle. Fire is not known to have negative long-term effects on elk populations, and considerable information indicates fire can significantly improve elk habitat (Lyon and Ward 1982). Within the Northwestern Hunt Zone, the climate is heavily marine influenced and moist, minimizing risk of wildfire which is not expected to be prevalent.

Wildfires have the potential to positively impact elk populations. Iinitially, fire may displace elk for a short time period (two to three months). However, elk often return to burned areas immediately following fire. Longer-term impacts may have significant positive effects on local populations. For example, a wildfire may burn habitat used by elk, causing short-term loss of some forage and cover. However, elk move back into the burned areas quickly to utilize the young nutritious forage growing in the burned areas (T. Burton, Department of Fish and Wildlife, Yreka, personal communication). Also, since elk are primarily grazing animals, eating mostly grasses, fires thatburn brush and trees open areas to allow more grasses to grow, and thus benefit elk (Lyon and Ward 1982).

Based on the above information, the possibility of wildfires impairing the statewide Roosevelt, Rocky Mountain, or tule elk populations from persisting in a healthy, viable condition is very unlikely. Evaluation of elk herd and habitat conditions and trends is an ongoing element of the Department's elk management program. Information collected by the Department and other sources will be used to modify any future

recommendations for hunting programs and to recommend other management activities, such as habitat improvement or acquisition projects. The impacts, if any, of a catastrophic event on elk populations would be addressed in carrying out any future management actions. In addition, the Commission has the regulatory authority (Section 314, FGC) to take emergency action to cancel or suspend elk hunting if a catastrophic event occurs which, in conjunction with a hunting program, could significantly impact the elk population. Thus, the Commission does not anticipate adverse impacts will occur as a result of wildfire in combination with the proposed project.

Effects of Disease

Historical data indicate elk are remarkably free of disease (Fowler 1985, Booth et al. 1988, Botti and Koch 1988, and Racine et al. 1988). However, Roosevelt elk tested in the Prairie Creek area of Humboldt County showed signs of heavy parasite levels and poor body condition in 1960 and 1982 (Department of Fish and Game files). The Department routinely collects blood samples from the majority of elk captured. Over the last 20 years, the Department has analyzed approximately 900 tule elk and 200 Roosevelt elk blood samples to systematically determine the prevalence of disease and assess the general health of the State's elk.

Recent concern has grown about effects of Chronic Wasting Disease (CWD) on deer and elk in North America (Williams et al., 2002). CWD is a fatal, contagious transmissible spongiform encephalopathy infecting the brains of deer and elk. It has been diagnosed within numerous states and provinces of North America. The Department began a surveillance program in 1999 and has tested more than 900 samples from California deer for CWD. All results to date have been negative. California is considered a low risk state for CWD; game ranching of cervids is not allowed (except for fallow deer), and importing live cervids is severely restricted. CWD is not currently known to be naturally transmitted to humans or animals other than deer and elk. On August 30, 2002, the Fish and Game Commission adopted emergency regulations placing conditions on the importation of hunter-harvested deer and elk into California. Those restrictions, which prohibit the importation and/or possession of brain matter or spinal cord of a deer, elk or cervid from another state, were made permanent. The Department has established a task force to expand its disease monitoring efforts and improved surveillance for CWD (and other diseases) to improve preparedness should CWD emerge in California.

There is no indication of a potential for the State's elk populations (either statewide or locally) to be significantly impacted by a major disease outbreak. There are no data available to indicate that disease, road kills, predation or other natural mortality factors will act as additive impacts which, along with the proposed hunting program, will have a significant adverse cumulative impact on local or statewide elk populations.

Effects of Habitat Loss and Degradation

The proposed project is not likely to cause habitat loss and degradation. The removal of individuals may actually improve elk habitat by decreasing grazing intensity. The elk hunting season is short, and most of the hunting areas are generally open to the public for other uses year-round. The effects on habitat loss and degradation by hunters during the elk hunting season would be negligible.

On private land, there are potential changes in land ownership which may result in land-use changes. No major changes in private land-use patterns are expected in the near future. The long-term outlook for elk habitat on public lands in California is stable to improving. The cumulative impacts of habitat modification plus hunting are not expected to have a significant adverse impact on elk populations. In combination with the proposed project, potential habitat modification/ degradation is unlikely to have significant adverse cumulative effects.

Effects of Illegal Harvest

Illegal harvest of game mammals is difficult to quantify. It is likely that elk have been taken illegally from proposed hunt areas, as well as from other herds where hunting is not proposed. Department records indicate at least three citations per year involving illegal take/possession of elk were issued in 1997 and 1998. At least three citations involving elk were issued each year in 2000 and 2001. Illegal harvest of subspecies other than Roosevelt elk has occurred in California and other western states (Potter 1982).

Illegal take of tule elk has occurred in the Owens Valley, at Grizzly Island and Fort Hunter Liggett during recent tule elk seasons. One hunter at Grizzly Island was cited for taking two and one cited for taking a spike elk while possessing an antlerless tag. Similar incidents occurred in sporadically in the past. Such incidents of unintentional illegal take have occurred with other game animals in California and other western states. The Department conducts mandatory hunter orientations for some tule elk hunt sin California and emphasizes avoiding incidents of unintentional illegal take and distributes informational material to all elk tag holders. The Department will continue this emphasis in future orientations; additionally, the Department will continue to issue citations to individuals for illegally taking elk, regardless of whether or not such take is intentional. Even with such measures, however, some level of unintentional illegal take is expected to continue. Nevertheless, there is no indication that illegal harvest will, in combination with the proposed project, have significant adverse cumulative effects.

Effects of Depredation

Private property conflicts involving effects of elk on agricultural crops, fences, and other personal property have occurred, and are likely to continue wherever elk and humans coexist. Section 4181, FGC, provides for the killing of elk when private "property is

being damaged or is in danger of being damaged or destroyed." However, current Department policy is to attempt all reasonable and practical means of nonlethal control prior to issuing a depredation permit for elk.

Issuing depredation (kill) permits is considered as the final measure to alleviate localized private property conflicts involving elk; and the Department issued no elk depredation permits from 1989 until 2002. However, as elk populations have increased and distribution has expanded, conflicts on private property have increased in severity. Since 2002, the Department has issued approximately 19 elk depredation permits.

With the establishment of the SHARE Program, the Department offers recreational hunting opportunities in partnership with landowners to help alleviate effects of elk on private lands. This program provides incentives to to allow public access on private lands. The resulting hunting pressure helps alleviate some of the conflict and provides important recreational opportunities, which function as a tool for elk management.

In response to the increasing private property conflicts involving elk, the State Legislature passed Assembly Bill 1420 (AB1420, Laird; Chaptered September 4, 2003). Among other things, AB 1420 directs the Department to prepare a statewide elk management plan that identifies management activities necessary to alleviate private property damage caused by elk. The statewide Elk Conservation and Management Plan was completed and released in December 2018 (CDFW 2018). Prior to issuing an elk depredation permit, AB1420 requires the Department to verify damage caused by elk, provide a written summary of corrective measures to alleviate the problem, determine the viability of the subject elk herd and the minimum population numbers needed to sustain it, and finally to ensure that a permit will not reduce the herd below the minimum population level.

To alleviate private property conflicts involving elk, the Department will investigate the potential for expanding hunting opportunities. Because of the constraints in AB1420, the Commission does not anticipate adverse cumulative impacts to elk populations resulting from combined effects of the proposed project and issuance of depredation permits.

Effects of Vehicle-Caused Mortality

The number of elk killed by vehicles is not well documented. Unlike deer, very few elk in California appear to be killed by automobiles each year. Vehicle-caused elk mortalities have been reported (specifically with Roosevelt elk in Del Norte and Humboldt counties and tule elk in the Owens Valley and at Cache Creek) since 1990. Unreported incidents cannot be quantified. However, the Commission believes effects of vehicle-caused mortality on statewide and localized elk populations are minimal.

Conclusion

The Department has examined a variety of factors that might affect Roosevelt elk populations in the Northwestern elk zone. The Department does not anticipate adverse cumulative impacts to the local elk populations will occur as a result of the proposed project in combination with any factor discussed. However, if some unforeseen cataclysmic event should occur that threatens the welfare of either statewide elk populations or individual hunted populations, the Commission has the authority to take appropriate action, which may include emergency closure of seasons and/or reduction of future hunting opportunities.

Although hunting elk will result in the death of individual elk, limited tag quotas, short seasons, bag limits, and close monitoring of hunter activity in the field, will result in removing elk at a level below the individual herds' sustained-yield capabilities. The elk herds proposed for hunting will be maintained within specified management plan objective ranges. Statewide population levels for Roosevelt elk will remain stable. Therefore, significant adverse effects, individually or cumulatively, to elk populations are not expected to result from the proposed project. Additionally, no impacts from two or more separate factors have been identified where, when viewed alone would be minor, but whose combined effect would be significant. Because individual and cumulative negative impacts are not expected to occur, specific mitigation measures are unnecessary.

CHAPTER 3. ALTERNATIVES

ALTERNATIVE 1 - NO PROJECT (NO CHANGE- MAINTAIN CURRENT CONDITION)

Other than annual tag quota modifications proposed in response to herd productivity, implementation of the No Project Alternative would result in no change from the 2010 tag quota range for Northwestern California. The Department does not expect age and sex ratios to change appreciably under this alternative. Herd size is expected to remain stable or increase if currently below carrying capacity (Appendix 3). Since this alternative presents no changes to current levels of hunting activity and elk harvest, the no-project alternative would not lead to any potential significant impacts on the environment.

ALTERNATIVE 2 – INCREASED HARVEST

Alternative 2 represents management options that will achieve an increased harvest (IH) for Northwestern California by increasing the available tags to 60 instead of 20 in the proposed alternative. IH refers to a harvest strategy that maximizes the number of animals that can be harvested from a population, commensurate with the goals and objectives stated for that herd, for at least the following year. A potential issue with an IH management strategy is risk of overharvest. If overharvest occurs under an IH program, more conservative management strategies would be necessary the following year to address it. Based on the Department's current understanding of elk populations in the Northwestern Hunt Zone and the scenarios run in Elk Pop, an IH scenario may affect the ability to meet the statewide objective to increase populations by ten percent. While calf ratios are expected to increase in response to increased harvest under an IH program, herd growth in Northwestern California may be limited if an IH program is maintained for a ten-year period (Appendix 3). While impacts to the environment and the sustainability of California's elk population are not anticipated to be significant with this level of harvest, it may not achieve the Department's management objective of increasing the population by ten percent in suitable areas where depredation conflicts are minimal. Although the Northwestern Hunt Zone has experienced a significant increase in landowner conflicts, the Department does not recommend an IH strategy at this time but recognizes the importance and need for continued evaluation.

ALTERNATIVE 3 – REDUCED HARVEST

Alternative 3 represents management options for Northwestern California that will produce a relatively small increase in harvest by adding ten additional tags rather than 20. This reduced harvest (RH) is a strategy that provides hunting opportunities at reduced levels from those proposed under either IH or the proposed project. Calf ratios may increase slightly, whereas bull ratios are not expected to change appreciably under this alternative. Herd size is expected to remain stable or increase if currently below carrying capacity (Appendix 3). Since this alternative would reduce hunting opportunity, it does not achieve the Department's management objective of providing for diversified recreational opportunities for enjoyment of wildlife, within sustainable levels.

There are no significant long-term adverse impacts associated with the proposed project or any of the three alternatives described above. However, the Department recommends the proposed project because it is most compatible with objectives of population growth (Objective 1.2), increasing hunting opportunities (Objective 3.1), and reducing human-elk conflicts on private property (Objective 4.1) in the Department's Elk Conservation and Management plan (CDFW 2018). Alternative 1 would not increase hunting opportunities or help alleviate conflicts on private property. Alternative 2 (IH) may be warranted, and additional research efforts to improve understanding of elk distribution and population dynamics are necessary to consider that level of increase. The Department recognizes continued elk population growth and increasing human-elk conflicts as it works in partnership with other agencies, non-profits and landowners to develop long-term solutions consistent with management plan objectives. Whereas Alternative 3 (RH) may also achieve these objectives, it does not optimize public hunting opportunities or alleviation of conflicts on private property.

CHAPTER 4. RESPONSES TO COMMENTS ON THE PROPOSED PROJECT

In accordance with CEQA, public input and agency consultation were encouraged during the environmental review process. An NOP was provided to the State Clearinghouse, and all individuals and organizations which expressed an interest in elk management. No comments were received as a result of the NOP circulation.

The Department prepared a DSED regarding elk hunting (Section 364, Title 14, CCR). The DSED was made available for public review on February 14, 2019. In addition, correspondence was either emailed or letters sent to every county library for public posting and notice of the availability of the DSED. Comments received during the 45-day comment period are in Appendix 8. A formal notice letter proposing the 2019-20 elk hunting regulations dated November 7, 2018, was also sent on behalf of the Department and the Fish and Game Commission to California Tribes, who requested to be notified for CEQA projects. No California Tribes requested consultation.

LITERATURE CITED

Bakker, E. 1972. An island called California. Univ. of California Press, Berkeley.

Barbour, M.G., and J. Major, eds. 1977. Terrestrial vegetation of California. John Wiley and Sons, New York.

Barnes, E. P. 1925a. Elk in Del Norte County. California Fish and Game 11:90.

_____. 1925b. A few Roosevelt elk still exist in Del Norte County. California Fish and Game 11:142.

Booth, J., J. Swanson, and D. Koch. 1988. Management plan for the Cache Creek tule elk management unit. California Department of Fish and Game. Sacramento, California.

Botti, F. and D. Koch. 1988. Management plan for the Grizzly Island tule elk management unit. California Department of Fish and Game. Sacramento, California.

Bubenik, A.B. 1982. Physiology. Pp. 125-179 *in* J. W. Thomas and D.E. Toweill eds. Elk of North America, ecology and management. Stackpole Books, Harrisburg, PA 698 pp.

Burcham, L.T. 1975. Climate, structure, and history of California's annual grassland ecosystem. Pages 7-14 *in* R.M. Love, ed. The California annual grassland ecosystem. Univ. of California, Davis, Inst. of Ecology Publ. No. 7.

California Department of Fish and Game. 2004. Final Environmental Document, Section 364, Title 14, California Code of Regulations, Regarding Elk Hunting. State of California, The Resources Agency, Department of Fish and Game. 300 pp.

California Department of Fish and Game. 2010. Final Environmental Document, Section 364, Title 14, California Code of Regulations, Regarding Elk Hunting. State of California, The Resources Agency, Department of Fish and Game. 48 pp.

California Department of Fish and Wildlife, 2018. Elk Conservation and Management Plan. State of California, The Resources Agency, Department of Fish and Wildlife. 471 pp.

California Department of Water Resources, 2015. California's Most Significant Droughts: Comparing Historical and Recent Conditions. State of California, The Resources Agency, Department of Water Resources. 136 pp.

Clutton-Brock, T.H., F.E. Guiness, and S.D. Albon. 1982. Red deer: behavior and ecology of two sexes. Univ. Chicago Press. 378 pp.

deVos, J. C., Jr. and T. McKinney. 2003. Recent trends in North American mountain lion populations: a hypothesis. Pages 297-307 *in* C. van Riper III and D. J. Mattson, editors. The Colorado Plateau II, University of Arizona Press, Tucson.

Fowler, G.S. 1985. Tule elk in California: history, current status, and management recommendations. California Department of Fish and Game, 1416 Ninth Street. Sacramento, California 95814. Interagency Agreement #C-698.

Fredrickson, E., K. M. Havstad, R. Estell, and P. Hyder. 1998. Perspectives on desertification: south-western United States. Journal of Arid Environments 39:191-207.

Geist, V. 1982. Adaptive behavioral strategies. Pp. 219-277 in J. W. Thomas and D. E. Toweill eds. Elk of North America, ecology and management. Stackpole Books, Harrisburg, PA 698 pp.

Harper, J.A., J.H. Harn, W.W. Bentley, and C.F. Yocom. 1967. The status and ecology of the Roosevelt elk in California. Wildlife Monographs No. 16. Washington D.C. The Wildlife Society. 49 pp.

Hebblewhite, M. 2005. Predation by wolves interacts with the North Pacific Oscillation (NPO) on a western North American elk population. Journal of Animal Ecology 74:226-233.

Hines, W., J. Lemos, and N. Hartmen. 1985. Male breeding efficiency in Roosevelt elk of southwestern Oregon. Wildlife Research Report Number 15. Oregon Department of Fish and Wildlife, P.O. Box 3503, Portland, Oregon 97208.

Hobbs, N.T., J.S. Baron, D.J. Cooper, M.B. Coughenour, A. Covich, J. Dickens, H. Galbraith, L. Landrum, J. Loomis, M. McDuff, D. Ojima, D.M. Theobold, and S. Weiler. 2006. An integrated assessment of the effects of climate change on Rocky Mountain National Park and its gateway community: interactions of multiple stressors. Final report to the U.S. Environmental Protection Agency

Koenig, W.D., W.J. Carmen, M.T. Stanback, and R.L. Mumme. 1991. In press. Determinants of acorn productivity among five species of oaks in central coastal California. Symposium on California's Oak Woodlands and Hardwood Rangeland.

Lindzey, F.G., W.G. Hepworth, T.A. Mattson and A.F. Reeves 1997. Potential for competition interactions between mule deer and elk in the Western United States and Canada: A Review. Wyoming Cooperative Fisheries and Wildlife Research Unit, Laramie, WY. 84pp.

Lyon, J. and L. Ward. 1982. Elk and land management. Pp. 443-477 *in* J. W. Thomas and D.E. Toweill (eds.). Elk of North America, ecology and management. Stackpole Books. Harrisburg, Pennsylvania. 698 pp.

McCullough, D.R. 1969. The Tule Elk: Its History, Behavior and Ecology. University of California Publ. in Zoology. No. 88. University of California Press. Berkeley, California. 209 pp.

McCullough, D.R. 1979. The George Reserve deer herd: population ecology of a selected species. Univ. Michigan Press. Ann Arbor. 271 pp.

McCullough, D.R. 1984. Lessons from the George Reserve. Pp. 211-242. *in* L. K. Halls (ed.). White-tailed deer: ecology and management. Stackpole Books. Harrisburg, Pennsylvania. 870 pp.

Mohler, L. and D.E. Toweill. 1982. Regulated elk populations and hunter harvests. Pp. 561-598 *in* J. W. Thomas and Dale E. Toweill (eds.). Elk of North America, ecology and management. Stackpole Books. Harrisburg, Pennsylvania. 698 pp.

Munz, P.A. and D.D. Keck. 1973. A California flora with supplement. Univ. of California Press, Berkeley.

Murie, O.J. 1951. The Elk of North America. Wildlife Management Institute. Stackpole Books, Harrisburg, PA. 376 pp.

Nelson, J. and T.A. Leege. 1982. Nutritional requirements and food habits. Pp. 323-368 in J. W. Thomas and D.E. Toweill (eds.). Elk of North America, ecology and management. Stackpole Books. Harrisburg, Pennsylvania. 698 pp.

Ornduff, R. 1974. Introduction to California plant life. University of California Press, Berkeley.

Potter, D.R. 1982. Recreational use of elk. Pp. 509-559 in J.W. Thomas and D.G. Toweill eds. Elk of North America, ecology and management. Stackpole Books. Harrisburg, PA. 698 p.

Racine, D., T. Blankinship, and D. Koch. 1988. Management plan for the Owens Valley tule elk management unit. California Department of Fish and Game. Sacramento, California.

Ricker, W.E. 1954. Stock and Recruitment. Journal of the Fisheries Resources Board Canada. 11:559-623.

Savidge, I.R. and J.S. Ziesenis. 1980. Sustained yield Management. Pp. 405-410 *in* Sanford D. Schemnitz (ed.). Wildlife Management Techniques Manual. The Wildlife Society. Washington, D.C. 686 pp.

Smith, D. and D. Updike. 1987. Elk Pop, unpublished computer population simulation model. Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814.

Taber, R.D., K. Raedeke, and D.A. McCaughran. 1982. Population characteristics. Pp. 279-300 in J. W. Thomas and D. E. Toweill (eds.). Elk of North America, ecology and management. Stackpole Books. Harrisburg, Pennsylvania. 698 pp.

Williams, E.S., M.W. Miller, T.J. Kreeger, R.H. Kahn, and E.T. Thorne. 2002. Chronic wasting disease of deer and elk: a review with recommendations for management. Journal of Wildlife Management, 66(3): 551-563.

Appendix 1. CEQA Environmental Checklist Form

CEQA Appendix G:
Environmental Checklist form

NOTE: The following is a sample form and may be tailored to satisfy individual agencies' needs and project circumstances. It may be used to meet the requirements for an initial study when the criteria set forth in CEQA Guidelines have been met. Substantial evidence of potential impacts that are not listed on this form must also be considered. The sample questions in this form are intended to encourage thoughtful assessment of impacts, and do not necessarily represent thresholds of significance.

1. Project title: Elk Hunting
2. Lead agency name and address:
   California Fish and Game Commission
   1416 9th Street, Suite 1320
   Sacramento, CA 95814
3. Contact person and phone number: Kari Lewis, Chief, Wildlife Branch - (916) 445-3789
4. Project location: Statewide
5. Project sponsor's name and address:
   California Department of Fish and Wildlife
   Wildlife Branch, 1812 9th Street
   Sacramento, CA 95811
6. General plan designation: N/A
7. Zoning: N/A
8. Description of project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.) The proposed project would increase the tag quota range (by 20 tags) in the Northwestern Elk Zone
9. Surrounding land uses and setting: Briefly describe the project's surroundings:
   The project occurs in areas in Del Norte and Humboldt Counties open to elk hunting.
10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)
    N/A
11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, has consultation begun?

    No.

    NOTE: Conducting consultation early in the CEQA process allows tribal governments, lead agencies, and project proponents to discuss the level of environmental review, identify and address potential adverse impacts to tribal cultural resources, and reduce the potential for delay and conflict in the environmental review process. (See Public Resources Code section 21083.3.2.) Information may also be available from the California Native American Heritage Commission's Sacred Lands File per Public Resources Code section 5097.96 and the California Historical Resources Information System administered by the California Office of Historic Preservation. Please also note that Public Resources Code section 21082.3(c) contains provisions specific to confidentiality.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agriculture and Forestry Resources	☐ Air Quality
☒ Biological Resources	☐ Cultural Resources	☐ Geology /Soils
☐ Greenhouse Gas Emissions	☐ Hazards & Hazardous Materials	☐ Hydrology/ Water Quality
☐ Land Use / Planning	☐ Mineral Resources	☐ Noise
☐ Population / Housing	☐ Public Services	☒ Recreation
☐ Transportation/Traffic	☐ Tribal Cultural Resources	☐ Utilities/Service Systems
☐ Mandatory Findings of Significance		

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT equivalent under the Commission's Certified Regulatory Plan is required.

[^] I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An SUPPLEMENTAL ENVIRONMENTAL IMPACT REPORT equivalent under the Commission's Certified Regulatory Plan is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature _____ Date 2/19/19

EVALUATION OF ENVIRONMENTAL IMPACTS:

1) A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from "Earlier Analyses," as described in (5) below, may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:

   a) Earlier Analysis Used. Identify and state where they are available for review.

   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

   c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:

   a) the significance criteria or threshold, if any, used to evaluate each question; and

   b) the mitigation measure identified, if any, to reduce the impact to less than significance Issues:

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS. Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒
II. AGRICULTURE AND FORESTRY RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒
III. AIR QUALITY. Where available, the significance criteria established by the applicable air quality management or				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☒
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☒
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒
IV. BIOLOGICAL RESOURCES: Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☒	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☐	☒
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. GEOLOGY AND SOILS. Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☐	☒
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☒
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒
VII. GREENHOUSE GAS EMISSIONS. Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☐	☒
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒
VIII. HAZARDS AND HAZARDOUS MATERIALS. Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒
IX. HYDROLOGY AND WATER QUALITY. Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☒
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	☒
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	☒
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
Insurance Rate Map or other flood hazard delineation map?				
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒
X. LAND USE AND PLANNING. Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒
XI. MINERAL RESOURCES. Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒
XII. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☒
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
XIII. POPULATION AND HOUSING. Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
XIV. PUBLIC SERVICES.				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	☐	☐	☐	☒
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒
XV. RECREATION.				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒
XVI. TRANSPORTATION/TRAFFIC.				
Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?				
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	☒
XVII. TRIBAL CULTURAL RESOURCES				
a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
i) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	☐	☐	☐	☒
ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☐	☐	☒
VIII. UTILITIES AND SERVICE SYSTEMS. Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
facilities, the construction of which could cause significant environmental effects?				
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒
XIX. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☐	☒
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

Note: Authority cited: Sections 21083 and 21083.05, 21083.09 Public Resources Code. Reference: Section 65088.4, Gov. Code; Sections 21073, 21074 21080(c), 21080.1, 21080.3, 21083, 21083.05, 21083.3, 21080.3.1, 21080.3.2,21082.3, 21084.2, 21084.3, 21093, 21094, 21095, and 21151, Public Resources Code; *Sundstrom v. County of Mendocino,*(1988) 202 Cal.App.3d 296; *Leonoff v. Monterey Board of Supervisors,* (1990) 222 Cal.App.3d 1337; *Eureka Citizens for Responsible Govt. v. City of Eureka* (2007) 147 Cal.App.4th 357; *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal.App.4th at 1109; *San Franciscans Upholding the Downtown Plan v. City and County of San Francisco* (2002) 102 Cal.App.4th 656.

Appendix 2 - 2019 Proposed Elk Tag Allocation for the Northwest Zone. Tags will be distributed between general draws and SHARE hunts.

	2018 Tag Allocation	2018 Tag Range	2019 Tag Range (Proposed)
Bull	20	0-20	0-28
Antlerless	22	0-22	0-34
Either-sex	3	0-3	0-3

Appendix 3. Computer Model Runs (Elk Pop) Harvest

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NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM, SHARE TAGS, 2019
(Combined Harvest for Del Norte and Humboldt cos)
              Ratio = 37/100/32 - Maximum Calf Survival = 40%
                 THIS PROGRAM CALCULATES CHANGES IN HERD
                 CHARACTERISTICS BASED ON VARIOUS HARVEST
                 RATES.

CURRENT CONDITIONS  =  NO CHANGE. GENERAL, COOP ELK, SHARE AND PLM TAGS TO
                              44 BULLS AND 21 ANTLERLESS
HARVEST APPROXIMATELY         ELK

                                        HERD SIZE      1600  ELK
       % BULLS LOST TO NON HUNTING CAUSES             23.5  %
        % COWS LOST TO NON HUNTING CAUSES             11.9  %
                % OF BULLS KILLED BY HUNTERS         12.55  %
                 % OF COWS KILLED BY HUNTERS           2.2  %
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		BULLS	COWS	SURV. CALVES	TOTAL	K	BULLS HARVEST	COWS HARVEST
START	AUG	350	947	303	1600	1600	44	21
YEAR 1	"	350	949	301	1600	1600	44	21
YEAR 2	"	349	950	300	1600	1600	44	21
YEAR 3	"	349	951	300	1600	1600	44	21
YEAR 4	"	348	952	300	1600	1600	44	21
YEAR 5	"	348	952	300	1600	1600	44	21
YEAR 6	"	347	953	300	1600	1600	44	21
YEAR 7	"	347	953	300	1600	1600	44	21
YEAR 8	"	347	953	300	1600	1600	44	21
YEAR 9	"	347	953	300	1600	1600	44	21
YEAR 10	"	347	954	300	1600	1600	44	21

		BULL RATIO	CALF RATIO
START		37	32
POST HUNT YR	1	33	32
POST HUNT YR	2	33	32
POST HUNT YR	3	33	32
POST HUNT YR	4	33	32
POST HUNT YR	5	33	32
POST HUNT YR	6	33	32
POST HUNT YR	7	33	32
POST HUNT YR	8	33	32
POST HUNT YR	9	33	32
POST HUNT YR	10	33	32

NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM, SHARE TAGS, 2019
(Combined Harvest for Del Norte and Humboldt cos)
Ratio = 37/100/32 - Maximum Calf Survival = 40%
THIS PROGRAM CALCULATES CHANGES IN HERD
CHARACTERISTICS BASED ON VARIOUS HARVEST
RATES.

CURRENT CONDITIONS = NO CHANGE. GENERAL, COOP ELK, SHARE AND PLM TAGS TO
44 BULLS AND 21 ANTLERLESS
HARVEST APPROXIMATELY ELK

HERD SIZE	1600	ELK
% BULLS LOST TO NON HUNTING CAUSES	23.5	%
% COWS LOST TO NON HUNTING CAUSES	11.9	%
% OF BULLS KILLED BY HUNTERS	12.55	%
% OF COWS KILLED BY HUNTERS	2.2	%

		BULLS	COWS	SURV. CALVES	TOTAL	K	BULLS HARVEST	COWS HARVEST
START	AUG	350	947	303	1600	1600	44	21
YEAR 1	"	350	949	370	1670	1760	44	21
YEAR 2	"	376	981	371	1728	1760	47	22
YEAR 3	"	393	1009	358	1760	1760	49	22
YEAR 4	"	400	1027	333	1760	1760	50	23
YEAR 5	"	395	1031	333	1760	1760	50	23
YEAR 6	"	392	1036	333	1760	1760	49	23
YEAR 7	"	389	1039	332	1760	1760	49	23
YEAR 8	"	387	1041	331	1760	1760	49	23
YEAR 9	"	386	1043	331	1760	1760	48	23
YEAR 10	"	385	1045	331	1760	1760	48	23

		BULL RATIO	CALF RATIO
START		37	32
POST HUNT YR	1	33	40
POST HUNT YR	2	34	39
POST HUNT YR	3	35	36
POST HUNT YR	4	35	33
POST HUNT YR	5	34	33
POST HUNT YR	6	34	33
POST HUNT YR	7	34	33
POST HUNT YR	8	33	33
POST HUNT YR	9	33	32
POST HUNT YR	10	33	32

NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM, SHARE TAGS, 2019
(Combined Harvest for Del Norte and Humboldt cos)
Ratio = 37/100/32 - Maximum Calf Survival = 40%
THIS PROGRAM CALCULATES CHANGES IN HERD
CHARACTERISTICS BASED ON VARIOUS HARVEST
RATES.

INCREASED PROPOSAL: ADD 24 BULL AND 36 ANTLERLESS (SHARE) TAGS TO
68 BULLS AND 57 ANTLERLESS
HARVEST APPROXIMATELY ELK

HERD SIZE	1600	ELK
% BULLS LOST TO NON HUNTING CAUSES	23.5	%
% COWS LOST TO NON HUNTING CAUSES	11.9	%
% OF BULLS KILLED BY HUNTERS	19.55	%
% OF COWS KILLED BY HUNTERS	6	%

		BULLS	COWS	SURV. CALVES	TOTAL	K	BULLS HARVEST	COWS HARVEST
START	AUG	350	947	303	1600	1600	44	21
YEAR 1	"	350	949	301	1600	1600	68	57
YEAR 2	"	331	918	351	1600	1600	65	55
YEAR 3	"	338	915	345	1598	1600	66	55
YEAR 4	"	340	910	344	1594	1600	66	55
YEAR 5	"	341	905	342	1588	1600	67	54
YEAR 6	"	341	900	340	1581	1600	67	54
YEAR 7	"	340	896	339	1574	1600	66	54
YEAR 8	"	339	891	337	1566	1600	66	53
YEAR 9	"	337	886	335	1558	1600	66	53
YEAR 10	"	336	881	333	1550	1600	66	53

		BULL RATIO	CALF RATIO
START		37	32
POST HUNT YR	1	32	34
POST HUNT YR	2	31	41
POST HUNT YR	3	32	40
POST HUNT YR	4	32	40
POST HUNT YR	5	32	40
POST HUNT YR	6	32	40
POST HUNT YR	7	32	40
POST HUNT YR	8	33	40
POST HUNT YR	9	33	40
POST HUNT YR	10	33	40

NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM, SHARE TAGS, 2019
(Combined Harvest for Del Norte and Humboldt cos)
Ratio = 37/100/32 - Maximum Calf Survival = 40%
THIS PROGRAM CALCULATES CHANGES IN HERD
CHARACTERISTICS BASED ON VARIOUS HARVEST
RATES.

INCREASED PROPOSAL: ADD 24 BULL AND 36 ANTLERLESS (SHARE) TAGS TO
68 BULLS AND 57 ANTLERLESS
HARVEST APPROXIMATELY ELK

HERD SIZE	1600	ELK
% BULLS LOST TO NON HUNTING CAUSES	23.5	%
% COWS LOST TO NON HUNTING CAUSES	11.9	%
% OF BULLS KILLED BY HUNTERS	19.55	%
% OF COWS KILLED BY HUNTERS	6	%

		BULLS	COWS	SURV. CALVES	TOTAL	K	BULLS HARVEST	COWS HARVEST
START	AUG	350	947	303	1600	1600	44	21
YEAR 1	"	350	949	370	1670	1760	68	57
YEAR 2	"	357	949	357	1663	1760	70	57
YEAR 3	"	356	943	357	1656	1760	70	57
YEAR 4	"	356	938	355	1649	1760	70	56
YEAR 5	"	355	933	353	1641	1760	69	56
YEAR 6	"	353	928	351	1632	1760	69	56
YEAR 7	"	352	923	349	1624	1760	69	55
YEAR 8	"	350	918	347	1615	1760	68	55
YEAR 9	"	348	913	345	1607	1760	68	55
YEAR 10	"	346	909	343	1598	1760	68	55

		BULL RATIO	CALF RATIO
START		37	32
POST HUNT YR	1	32	42
POST HUNT YR	2	32	40
POST HUNT YR	3	32	40
POST HUNT YR	4	32	40
POST HUNT YR	5	33	40
POST HUNT YR	6	33	40
POST HUNT YR	7	33	40
POST HUNT YR	8	33	40
POST HUNT YR	9	33	40
POST HUNT YR	10	33	40

NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM,SHARE TAGS, 2019
(Combined Harvest for Del Norte and Humboldt cos)
Ratio = 37/100/32 - Maximum Calf Survival = 40%

THIS PROGRAM CALCULATES CHANGES IN HERD CHARACTERISTICS BASED ON VARIOUS HARVEST RATES.

PROPOSED PROJECT: ADD 8 BULL AND 12 ANTLERLESS (SHARE) TAGS TO HARVEST APPROXIMATELY 52 BULLS AND 33 ANTLERLESS ELK

HERD SIZE	1600	ELK
% BULLS LOST TO NON HUNTING CAUSES	23.5	%
% COWS LOST TO NON HUNTING CAUSES	11.9	%
% OF BULLS KILLED BY HUNTERS	14.9	%
% OF COWS KILLED BY HUNTERS	3.5	%

		BULLS	COWS	SURV. CALVES	TOTAL	K	BULLS HARVEST	COWS HARVEST
START	AUG	350	947	303	1600	1600	44	21
YEAR 1	"	350	949	301	1600	1600	52	33
YEAR 2	"	343	939	318	1600	1600	51	33
YEAR 3	"	345	939	317	1600	1600	51	33
YEAR 4	"	346	937	317	1600	1600	51	33
YEAR 5	"	346	937	317	1600	1600	52	33
YEAR 6	"	347	936	317	1600	1600	52	33
YEAR 7	"	347	935	317	1600	1600	52	33
YEAR 8	"	347	935	317	1600	1600	52	33
YEAR 9	"	348	935	318	1600	1600	52	33
YEAR 10	"	348	935	318	1600	1600	52	33

		BULL RATIO	CALF RATIO
START		37	32
POST HUNT YR	1	33	33
POST HUNT YR	2	32	35
POST HUNT YR	3	32	35
POST HUNT YR	4	33	35
POST HUNT YR	5	33	35
POST HUNT YR	6	33	35
POST HUNT YR	7	33	35
POST HUNT YR	8	33	35
POST HUNT YR	9	33	35
POST HUNT YR	10	33	35

NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM,SHARE TAGS, 2019
(Combined Harvest for Del Norte and Humboldt cos)
Ratio = 37/100/32 - Maximum Calf Survival = 40%

THIS PROGRAM CALCULATES CHANGES IN HERD CHARACTERISTICS BASED ON VARIOUS HARVEST RATES.

PROPOSED PROJECT: ADD 8 BULL AND 12 ANTLERLESS (SHARE) TAGS TO HARVEST APPROXIMATELY 52 BULLS AND 33 ANTLERLESS ELK

HERD SIZE	1600	ELK
% BULLS LOST TO NON HUNTING CAUSES	23.5	%
% COWS LOST TO NON HUNTING CAUSES	11.9	%
% OF BULLS KILLED BY HUNTERS	14.9	%
% OF COWS KILLED BY HUNTERS	3.5	%

		BULLS	COWS	SURV. CALVES	TOTAL	K	BULLS HARVEST	COWS HARVEST
START	AUG	350	947	303	1600	1600	44	21
YEAR 1	"	350	949	370	1670	1760	52	33
YEAR 2	"	370	970	366	1706	1760	55	34
YEAR 3	"	381	986	374	1741	1760	57	35
YEAR 4	"	391	1003	366	1760	1760	58	35
YEAR 5	"	394	1014	352	1760	1760	59	35
YEAR 6	"	391	1017	352	1760	1760	58	36
YEAR 7	"	389	1020	351	1760	1760	58	36
YEAR 8	"	388	1021	351	1760	1760	58	36
YEAR 9	"	387	1023	350	1760	1760	58	36
YEAR 10	"	386	1024	350	1760	1760	57	36

		BULL RATIO	CALF RATIO
START		37	32
POST HUNT YR	1	33	40
POST HUNT YR	2	34	39
POST HUNT YR	3	34	39
POST HUNT YR	4	34	38
POST HUNT YR	5	34	36
POST HUNT YR	6	34	36
POST HUNT YR	7	34	36
POST HUNT YR	8	33	36
POST HUNT YR	9	33	36
POST HUNT YR	10	33	35

NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM, SHARE TAGS, 2019
(Combined Harvest for Del Norte and Humboldt cos)
Ratio = 37/100/32 - Maximum Calf Survival = 40%
THIS PROGRAM CALCULATES CHANGES IN
HERD
CHARACTERISTICS BASED ON VARIOUS
HARVEST
RATES.

REDUCED PROPOSAL: ADD 4 BULL AND 6 ANTLERLESS (SHARE) TAGS TO
HARVEST APPROXIMATELY 48 BULLS AND 27 ANTLERLESS ELK

HERD SIZE	1600	ELK
% BULLS LOST TO NON HUNTING CAUSES	23.5	%
% COWS LOST TO NON HUNTING CAUSES	11.9	%
% OF BULLS KILLED BY HUNTERS	13.8	%
% OF COWS KILLED BY HUNTERS	2.85	%

		BULLS	COWS	SURV. CALVES	TOTAL	K	BULLS HARVEST	COWS HARVEST
START	AUG	350	947	303	1600	1600	44	21
YEAR 1	"	350	949	301	1600	1600	48	27
YEAR 2	"	346	945	309	1600	1600	48	27
YEAR 3	"	346	945	309	1600	1600	48	27
YEAR 4	"	347	945	309	1600	1600	48	27
YEAR 5	"	347	945	309	1600	1600	48	27
YEAR 6	"	347	944	309	1600	1600	48	27
YEAR 7	"	347	944	309	1600	1600	48	27
YEAR 8	"	347	944	309	1600	1600	48	27
YEAR 9	"	347	944	309	1600	1600	48	27
YEAR 10	"	347	944	309	1600	1600	48	27

		BULL RATIO	CALF RATIO
START		37	32
POST HUNT YR	1	33	33
POST HUNT YR	2	32	34
POST HUNT YR	3	33	34
POST HUNT YR	4	33	34
POST HUNT YR	5	33	34
POST HUNT YR	6	33	34
POST HUNT YR	7	33	34
POST HUNT YR	8	33	34
POST HUNT YR	9	33	34
POST HUNT YR	10	33	34

NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM, SHARE TAGS, 2019
(Combined Harvest for Del Norte and Humboldt cos)
Ratio = 37/100/32 - Maximum Calf Survival = 40%
THIS PROGRAM CALCULATES CHANGES IN
HERD
CHARACTERISTICS BASED ON VARIOUS
HARVEST
RATES.

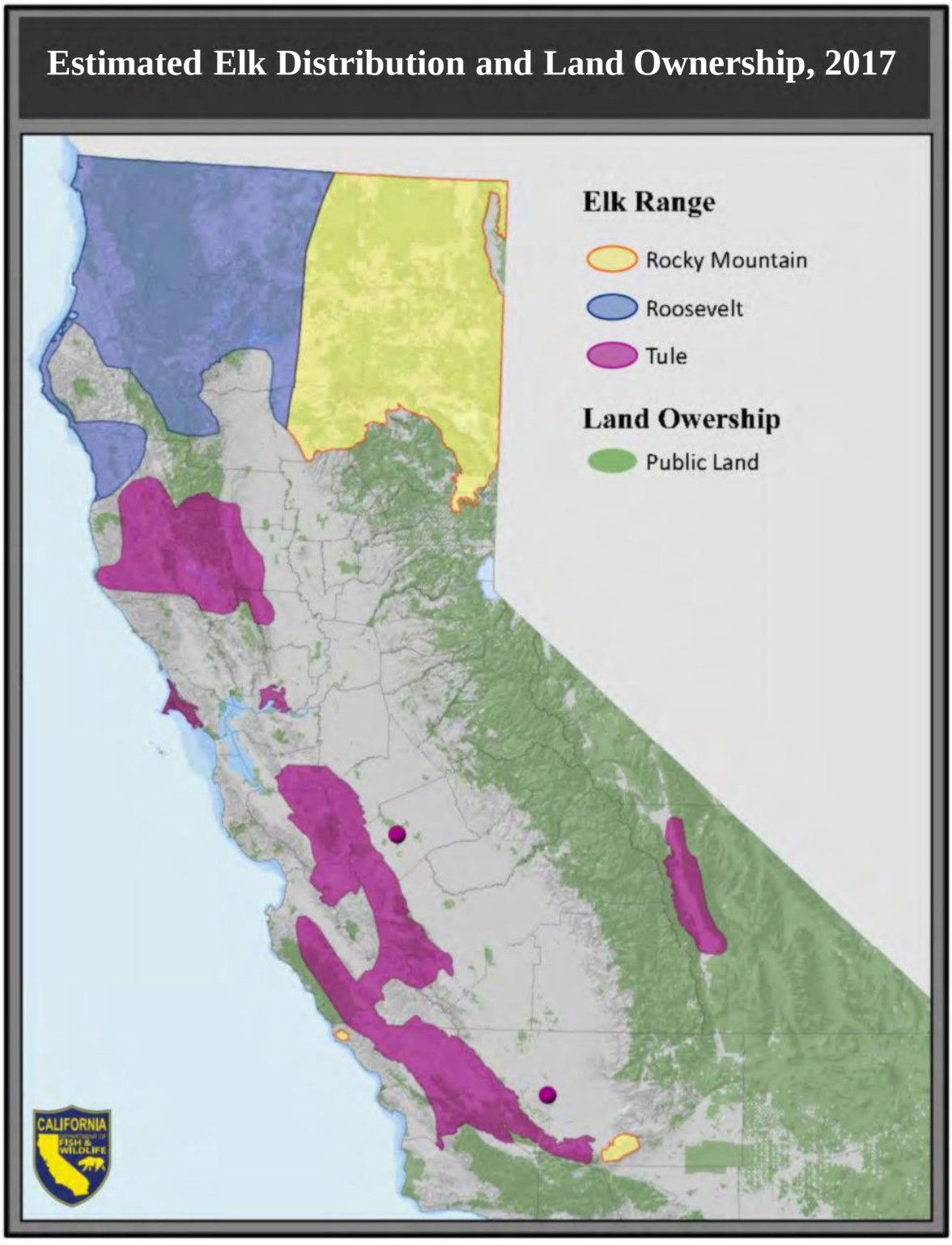
REDUCED PROPOSAL: ADD 4 BULL AND 6 ANTLERLESS (SHARE) TAGS TO
HARVEST APPROXIMATELY 48 BULLS AND 27 ANTLERLESS ELK

HERD SIZE	1600	ELK
% BULLS LOST TO NON HUNTING CAUSES	23.5	%
% COWS LOST TO NON HUNTING CAUSES	11.9	%
% OF BULLS KILLED BY HUNTERS	13.8	%
% OF COWS KILLED BY HUNTERS	2.85	%

		BULLS	COWS	SURV. CALVES	TOTAL	K		BULLS HARVEST	COWS HARVEST
START	AUG	350	947	303	1600	1600	|	44	21
YEAR 1	"	350	949	370	1670	1760	|	48	27
YEAR 2	"	373	975	369	1717	1760	|	51	28
YEAR 3	"	387	997	376	1760	1760	|	53	28
YEAR 4	"	399	1019	342	1760	1760	|	55	29
YEAR 5	"	394	1023	343	1760	1760	|	54	29
YEAR 6	"	391	1027	342	1760	1760	|	54	29
YEAR 7	"	389	1030	342	1760	1760	|	54	29
YEAR 8	"	387	1032	341	1760	1760	|	53	29
YEAR 9	"	386	1033	341	1760	1760	|	53	29
YEAR 10	"	385	1035	341	1760	1760	|	53	29

		BULL RATIO	CALF RATIO
START		37	32
POST HUNT YR	1	33	40
POST HUNT YR	2	34	39
POST HUNT YR	3	34	39
POST HUNT YR	4	35	35
POST HUNT YR	5	34	35
POST HUNT YR	6	34	34
POST HUNT YR	7	34	34
POST HUNT YR	8	33	34
POST HUNT YR	9	33	34
POST HUNT YR	10	33	34

Appendix 4. Estimated Elk Distribution and Land Ownership, 2017



Appendix 5. Current Elk Hunting Regulations

§364, Title 14, CCR. Elk.

- (a) Department Administered General Methods Roosevelt Elk Hunts:
  - (1) Siskiyou General Methods Roosevelt Elk Hunt:
    - (A) Area: In that portion of Siskiyou County 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.
  - (2) Northwestern California Roosevelt Elk Hunt:
    - (A) Area: In those portions of Humboldt and Del Norte counties within a line beginning at the intersection of Highway 299 and Highway 96, north along Highway 96 to the Del Norte-Siskiyou county line, north along the Del Norte-Siskiyou county line to the California-Oregon state line, west along the state line to the Pacific Coastline, south along the Pacific coastline to the Humboldt-Mendocino county line, east along the Humboldt-Mendocino county line to the Humboldt-Trinity county line, north along the Humboldt-Trinity county line to Highway 299, west along Highway 299 to the point of beginning.
  - (3) Marble Mountains General Methods Roosevelt Elk Hunt
    - (A) Area: In those portions of Humboldt, Tehama, Trinity, Shasta and Siskiyou counties 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 intersection of the Siskiyou-Humboldt county lines; east along the Siskiyou-Humboldt county lines to Highway 96; south along Highway 96 to Highway 299; south along Highway 299 to the Intersection of the Humboldt/Trinity County line; south along the Humboldt Trinity County Line to the intersection of Highway 36; east along Highway 36 to the intersection of Interstate 5; north on Interstate Highway 5 to the point of beginning.
- (b) Department Administered General Methods Rocky Mountain Elk Hunts:
  - (1) Northeastern California General Methods Rocky Mountain Elk Hunt:
    - (A) Area: Those portions of Siskiyou, Modoc, Lassen, and Shasta counties within a line beginning in Siskiyou County at the junction of the California-Oregon state line and Hill Road at Ainsworth Corner; east along the California-Oregon state line to the California-Nevada state line; south along the California-Nevada state line to the Tuledad-Red Rock-Clarks Valley Road (Lassen County Roads 506, 512 and 510); west along the Tuledad-Red Rock-Clarks Valley Road to Highway 395 at Madeline; west on USDA Forest Service Road 39N08 to the intersection of Highway 139/299 in Adin; south on Highway 139 to the intersection of Highway 36 in Susanville; west on Highway 36 to the intersection of Interstate 5 in Red Bluff; north on Interstate 5 to Highway 89; southeast along Highway 89 to USDA Forest Service Road 13 (Pilgrim Creek Road); northeast along USDA Forest Service Road 13 to USDA Forest Service Road 15 (Harris Spring Road); north along USDA Forest Service Road to USDA Forest Service Road 77; east along USDA Forest Service Road 77 to USDA Forest Service Road 49; north along USDA Forest Service Road 49 to Lava Beds National Monument Road; north along Lava Beds National Monument Road to Hill Road; north along Hill Road to the point of beginning.
- (c) Department Administered General Methods Roosevelt/Tule Elk Hunts:
  - (1) Mendocino General Methods Roosevelt/Tule Elk Hunt:
    - (A) Area: Those portions in Mendocino County 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 of Highway 20; north and west along Highway 20 to the intersection of Highway 101 near Calpella; south along Highway 101 to the intersection of Highway 253; southwest along Highway 253 to the intersection of Highway 128; north along Highway 128 to the intersection of Mountain View Road near the town of Boonville; west along Mountain View Road to the intersection of Highway 1; south along Highway 1 to the intersection of the Garcia River; west along the Garcia River to the Pacific Coastline; north along the Pacific Coastline to the point of beginning.

- (d) Department Administered General Methods Tule Elk Hunts:
  - (1) Cache Creek General Methods Tule Elk Hunt:
    - (A) Area: 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 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.
  - (2) La Panza General Methods Tule Elk Hunt:
    - (A) Area: In those portions of San Luis Obispo, Kern, Monterey, Kings, Fresno, San Benito, and Santa Barbara counties within a line beginning in San Benito County at the junction of Highway 25 and County Highway J1 near the town Pacines, south along Highway 25 to La Gloria road, west along La Gloria road, La Gloria road becomes Gloria road, west along Gloria road to Highway 101 near Gonzales, 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 5 in Fresno County, north along Interstate 5 to Little Panoche road/County Highway J1, southwest along Little Panoche road/County Highway J1 to the intersection of Little Panoche road/County Highway J1 and Panoche road/County Highway J1 in San Benito County, northwest along Panoche road/County Highway J1 to the point of beginning.
    - (B) Special Conditions: All tagholders will be required to attend a mandatory orientation. Tagholders will be notified of the time and location of the orientation meeting upon receipt of their elk license tags.
  - (3) Bishop General Methods Tule Elk Hunt:
    - (A) Area: In that portion of Inyo County beginning at the junction of Highway 395 and Highway 6 in the town of Bishop; north and east along Highway 6 to the junction of Silver Canyon Road; east along Silver Canyon Road to the White Mountain Road (Forest Service Road 4S01); south along the White Mountain Road to Highway 168 at Westgard Pass; south and west along Highway 168 to the junction of Highway 395; north on Highway 395 to the point of beginning.
  - (4) Independence General Methods Tule Elk Hunt:
    - (A) Area: In that portion of Inyo County beginning at the junction of Highway 395 and Aberdeen Station Road; east on Aberdeen Station Road to its terminus at the southern boundary of Section 5, Township 11S, Range 35E; east along the southern boundary of sections 5, 4, 3, and 2, Township 11S, Range 35E to the Papoose Flat Road at Papoose Flat; south and east on Papoose Flat Road to Mazourka Canyon Road; south and then west on Mazourka Canyon Road to Highway 395; north along Highway 395 to the point of beginning.
  - (5) Lone Pine General Methods Tule Elk Hunt:
    - (A) Area: In that portion of Inyo County beginning at the junction of Highway 395 and Mazourka Canyon Road; east and then north on Mazourka Canyon Road to the Inyo National Forest Boundary at the junction of the southern boundary of Township 12S

and the northern boundary of Township 13S; east along the southern boundary of Township 12S to Saline Valley Road; south on Saline Valley Road to Highway 190; north and then southwest on Highway 190 to the junction of Highway 395 at Olancha; north on Highway 395 to the point of beginning.

- (6) Tinemaha General Methods Tule Elk Hunt:
  - (A) Area: In that portion of Inyo County beginning at the junction of Highway 395 and Highway 168 in the town of Big Pine; north and east along Highway 168 to the junction of the Death Valley Road; south and east along the Death Valley Road to the junction of the Papoose Flat Road; south along the Papoose Flat Road to the southern boundary of Section 2, Township 11S, Range 35E; west along the southern boundaries of sections 2, 3, 4 and 5 to the terminus of the Aberdeen Station Road in Section 5, Township 11S, Range 35E; south and west along the Aberdeen Station Road to Highway 395; north along Highway 395 to the point of beginning.
- (7) West Tinemaha General Methods Tule Elk Hunt:
  - (A) Area: In that portion of Inyo County beginning at the junction of Highway 395 and Highway 168 in the town of Big Pine; south along Highway 395 to the north junction of Fish Springs Road; south along Fish Springs Road to the junction of Highway 395; south along Highway 395 to Taboose Creek in Section 14, Township 11S, Range 34E; west along Taboose Creek to the Inyo County line; north and west along the Inyo County line to the intersection of Tinemaha Creek; east along Tinemaha Creek to the intersection of McMurray Meadow Road; north on McMurray Meadow Road to the intersection of Glacier Lodge Road; north and east on Glacier Lodge Road to Crocker Avenue; east along Crocker Avenue to Highway 395; north along Highway 395 to the point of beginning.
- (8) Tinemaha Mountain General Methods Tule Elk Hunt:
  - (A) Area: In that portion of Inyo County with a line beginning at the intersection of Glacier Lodge Road (9S21) and McMurray Meadow Road (9S03); south on McMurray Meadow Road to Tinemaha Creek; west along Tinemaha Creek to the Inyo County line; north and west along the Inyo County line to the southeast corner of Section 23, Township 10S, Range 32E; north along the eastern boundaries of sections 23, 14, 11, 2, Township 10S, Range 32E, and the eastern boundary of Section 36, Township 9S, Range 32E to Glacier Lodge Road; east along Glacier Lodge Road to the beginning.
- (9) Whitney General Methods Tule Elk Hunt:
  - (A) Area: In that portion of Inyo County with a line beginning at the intersection of Highway 395 and Onion Valley Road; south on Highway 395 to the intersection of Whitney Portal Road; west along Whitney Portal Road to the northern boundary of Section 36, Township 15S, Range 34E; west along the northern boundary of sections 36, 35, 34 and 33 Township 15S, Range 34 E to the Inyo County Line; north along the Inyo County Line to the intersection of Section 27 Township 13S, range 33E; east along the southern boundary of sections 27, 26 and 25 Township 13S, Range 33E; north along the eastern boundary of Section 25 Township 13S, Range 33E to the intersection of Onion Valley Road; east along Onion Valley Road to the point of beginning.
- (10) Goodale General Methods Tule Elk Hunt:
  - (A) Area: In that portion of Inyo County beginning at the junction of Highway 395 and Onion Valley Road; west along Onion Valley Road to the intersection of the Section 25 Township 13S, Range 33E; south along the eastern boundary of Section 25 Township 13S, Range 33E to the southern boundary of Section 25 Township 13S, Range 33E; west along the southern boundary of sections 27, 26, 25 Township 13S, Range 33E to the Inyo County line; North along the Inyo County Line to Taboose Creek; east along Taboose Creek to the intersection of Highway 395; south along Highway 395 to the point of beginning.
- (11) Grizzly Island General Methods Tule Elk Hunt:
  - (A) Area: Those lands owned and managed by the Department of Fish and Game as the Grizzly Island Wildlife Area.

        - (B) Special Conditions: All tagholders will be required to attend a mandatory orientation. Tagholders will be notified of the time and location of the orientation meeting after receipt of their elk license tags.
    - (12) Fort Hunter Liggett General Public General Methods Tule Elk Hunt:
        - (A) Area: That portion of Monterey County lying within the exterior boundaries of Fort Hunter Liggett, except as restricted by the Commanding Officer.
        - (B) Fort Hunter Liggett Special Conditions: See subsection 364(p).
    - (13) East Park Reservoir General Methods Tule Elk Hunt:
        - (A) Area: In 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.
        - (B) Special Conditions:
            - 1. All tagholders will be required to attend a mandatory orientation. Tagholders will be notified of the time and location of the orientation meeting after receipt of their elk license tags.
            - 2. Access to private land may be restricted or require payment of an access fee.
            - 3. A Colusa County ordinance prohibits firearms on land administered by the USDI Bureau of Reclamation in the vicinity of East Park Reservoir. A variance has been requested to allow use of muzzleloaders (as defined in Section 353) on Bureau of Reclamation land within the hunt zone.
    - (14) San Luis Reservoir General Methods Tule Elk Hunt:
        - (A) Area: In those portions of Merced, Fresno, San Benito, and Santa Clara counties within a line beginning in Merced County at the junction of Highway 152 and Interstate 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 5 in Fresno County, north along Interstate 5 to the point of beginning.
    - (15) Bear Valley General Methods Tule Elk Hunt:
        - (A) Area: in those 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.
    - (16) Lake Pillsbury General Methods Tule Elk Hunt:
        - (A) Area: in those portions 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.

- (17) Santa Clara General Methods Tule Elk Hunt:
  - (A) Area: Those portions of Merced, Santa Clara, and Stanislaus Counties within the following line: beginning at the intersection of the Interstate 5 and the San Joaquin/Stanislaus County line; southeast along Interstate 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 680 near San Jose; north along Interstate 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.
- (18) Alameda General Methods Tule Elk Hunt:
  - (A) Area: Those portions of Alameda and San Joaquin Counties within the following line: beginning at the intersection of the Interstate 5 and the San Joaquin/Stanislaus County line; southwest along the San Joaquin/Stanislaus County line to the intersection of the San Joaquin, Stanislaus, Alameda, Santa Clara County lines; west along the Alameda/Santa Clara County Line to the intersection of Interstate 680; north along Interstate 680 to the intersection of Interstate 580; east and south along Interstate 580 to the intersection of Interstate 5; south along Interstate 5 to the point of beginning.

- (e) Department Administered General Methods Apprentice Elk Hunts:
  - (1) Marble Mountains General Methods Roosevelt Elk Apprentice Hunt:
    - (A) Area: The tag shall be valid in the area described in subsection 364(a)(3)(A).
    - (B) Special Conditions: Only persons possessing valid junior hunting licenses may apply for Apprentice Hunt license tags. Apprentice Hunt tagholders shall be accompanied by a nonhunting, licensed adult chaperon 18 years of age or older while hunting.
  - (2) Northeastern California General Methods Rocky Mountain Elk Apprentice Hunt:
    - (A) Area: The tag shall be valid in the area described in subsection 364(b)(1)(A).
    - (B) Special Conditions: Only persons possessing valid junior hunting licenses may apply for Apprentice Hunt License tags. Apprentice Hunt tagholders shall be accompanied by a nonhunting, licensed adult chaperon 18 years of age or older while hunting.
  - (3) Cache Creek General Methods Tule Elk Apprentice Hunt:
    - (A) Area: The tag shall be valid in the area described in subsection 364(d)(1)(A).
    - (B) Special Conditions:
      - 1. Only persons possessing valid junior hunting licenses may apply for Apprentice Hunt license tags. Apprentice Hunt tagholders shall be accompanied by a nonhunting, licensed adult chaperon 18 years of age or older while hunting.
  - (4) La Panza General Methods Tule Elk Apprentice Hunt:
    - (A) Area: The tag shall be valid in the area described in subsection 364(d)(2)(A).
    - (B) Special Conditions:
      - 1. All tagholders will be required to attend a mandatory orientation. Tagholders will be notified of the time and location of the orientation meeting after receipt of their elk license tags.
      - 2. Only persons possessing valid junior hunting licenses may apply for Apprentice Hunt license tags. Apprentice Hunter tagholders shall be accompanied by a nonhunting, licensed adult chaperon 18 years of age or older while hunting.
  - (5) Bishop General Methods Tule Elk Apprentice Hunt:
    - (A) Area: The tag shall be valid in the area described in subsection 364(d)(3)(A).

        - (B) Special Conditions: Only persons possessing valid junior hunting licenses may apply for Apprentice Hunt license tags. Apprentice Hunt tagholders shall be accompanied by a nonhunting, licensed adult chaperon 18 years of age or older while hunting.
    - (6) Grizzly Island General Methods Tule Elk Apprentice Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(11)(A).
        - (B) Special Conditions:
            - 1. All tagholders will be required to attend a mandatory orientation. Tagholders will be notified of the time and location of the orientation meeting after receipt of their elk license tags.
            - 2. Only persons possessing valid junior hunting licenses may apply for Apprentice Hunt license tags. Apprentice Hunt tagholders shall be accompanied by a nonhunting, licensed adult chaperon 18 years of age or older while hunting.
    - (7) Fort Hunter Liggett General Methods General Public Tule Elk Apprentice Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(12)(A).
        - (B) Special Conditions: See subsection 364(p).
        - (C) Only persons possessing valid junior hunting licenses may apply for Apprentice Hunt license tags. Apprentice Hunt tagholders shall be accompanied by a nonhunting, licensed adult chaperon 18 years of age or older while hunting.
- (f) Department Administered Archery Only Elk Hunts:
    - (1) Northeastern California Archery Only Rocky Mountain Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(b)(1)(A).
        - (B) Special Conditions: Elk may be taken with Archery Equipment only as specified in Section 354.
    - (2) Owens Valley Multiple Zone Archery Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in areas described in subsections 364(d)(3)(A), (d)(4)(A), (d)(5)(A), and (d)(10)(A).
        - (B) Special Conditions: Elk may be taken with Archery Equipment only as specified in Section 354.
    - (3) Lone Pine Archery Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(5)(A).
        - (B) Special Conditions: Elk may be taken with Archery Equipment only as specified in Section 354.
    - (4) Tinemaha Archery Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(6)(A).
        - (B) Special Conditions: Elk may be taken with Archery Equipment only as specified in Section 354.
    - (5) Whitney Archery Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(9)(A).
        - (B) Special Conditions: Elk may be taken with Archery Equipment only as specified in Section 354.
    - (6) Fort Hunter Liggett General Public Archery Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(12)(A).
        - (B) Special Conditions: See subsection 364(p).
        - (C) Elk may be taken with Archery Equipment only as specified in Section 354.
- (g) Department Administered Muzzleloader Only Elk Hunts:
    - (1) Bishop Muzzleloader Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(3)(A).
        - (B) Special Conditions: Elk may be taken with muzzleloader equipment only as specified in Section 353.
    - (2) Independence Muzzleloader Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(4)(A).
        - (B) Special Conditions: Elk may be taken with muzzleloader equipment only as specified in Section 353.
    - (3) Fort Hunter Liggett General Public Muzzleloader Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(12)(A).
        - (B) Special Conditions: See subsection 364(p).

        - (C) Elk may be taken with Muzzleloader Equipment only as specified in Section 353.
- (h) Department Administered Muzzleloader/Archery Only Elk Hunts:
    - (1) Marble Mountains Muzzleloader/Archery Only Roosevelt Elk Hunt.
        - (A) Area: The tag shall be valid in the area described in subsection 364(a)(3)(A).
        - (B) Special Conditions: Elk may be taken with archery or muzzleloader equipment only as specified in Sections 353 and 354.
- (i) Fund Raising Elk Hunts:
    - (1) Multi-zone Fund Raising Elk Hunt.
        - (A) Area: The tag shall be valid in the areas described in subsections 364(a)(1)(A), (a)(2)(A), (a)(3)(A), (b)(1)(A), and (d)(2)(A).
    - (2) Grizzly Island Fund Raising Tule Elk Hunt.
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(11)(A).
        - (B) Special Conditions: Advance reservations required by contacting the Grizzly Island Wildlife Area by telephone at (707) 425-3828.
    - (3) Owens Valley Fund Raising Tule Elk Hunt
        - (A) Area: The tag shall be valid in areas described in subsections 364(d)(3)(A), (d)(4)(A), (d)(5)(A), (d)(6)(A), (d)(7)(A), (d)(8)(A), (d)(9)(A), and (d)(10)(A).
- (j) Military Only Elk Hunts. These hunts are sponsored and tag quotas are set by the Department. The tags are assigned and the hunts are administered by the Department of Defense.
    - (1) Fort Hunter Liggett Military Only General Methods Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(12)(A).
        - (B) Special Conditions: See subsection 364(p).
    - (2) Fort Hunter Liggett Military Only General Methods Tule Elk Apprentice Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(12)(A).
        - (B) Special Conditions: See subsection 364(p).
        - (C) Only persons possessing valid junior hunting licenses may apply for Apprentice Hunt license tags. Apprentice Hunt tagholders shall be accompanied by a nonhunting, licensed adult chaperon 18 years of age or older while hunting.
    - (3) Fort Hunter Liggett Military Only Archery Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(12)(A).
        - (B) Special Conditions: See subsection 364(p).
        - (C) Elk may be taken with Archery Equipment only as specified in Section 354.
    - (4) Fort Hunter Liggett Military Only Muzzleloader Only Tule Elk Hunt:
        - (A) Area: The tag shall be valid in the area described in subsection 364(d)(12)(A).
        - (B) Special Conditions: See subsection 364(p).
- (k) Bag and Possession Limit: Each elk tag is valid only for one elk per season and only in the hunt area drawn.
- (l) Definitions:
    - (1) Bull elk: Any elk having an antler or antlers at least four inches in length as measured from the top of the skull.
    - (2) Spike bull: A bull elk having no more than one point on each antler. An antler point is a projection of the antler at least one inch long and longer than the width of its base.
    - (3) Antlerless elk: Any elk, with the exception of spotted calves, with antlers less than four inches in length as measured from the top of the skull.
    - (4) Either-sex elk: For the purposes of these regulations, either-sex is defined as bull elk, spike elk, or antlerless elk.
- (m) Method of Take: Only methods for taking elk as defined in Sections 353 and 354 may be used.
- (n) Tagholder Responsibilities:
    - (1) No tagholder shall take or possess any elk or parts thereof governed by the regulations except herein provided.
    - (2) The department reserves the right to use any part of the tagholder's elk for biological analysis as long as the amount of edible meat is not appreciably decreased.
    - (3) Any person taking an elk which has a collar or other marking device attached to it shall provide the department with such marking device within 10 days of taking the elk.
- (o) The use of dogs to take or attempt to take elk is prohibited.
- (p) Fort Hunter Liggett Special Conditions:

- (1) All tagholders hunting within the exterior boundaries of Fort Hunter Liggett will be required to attend a mandatory hunter orientation. Tagholders will be notified of the time and location of the orientation meeting upon receipt of their elk license tags.
- (2) Tagholders hunting within the exterior boundaries of Fort Hunter Liggett shall be required to purchase an annual hunting pass available from Fort Hunter Liggett.
- (3) All successful tagholders hunting within the exterior boundaries of Fort Hunter Liggett will be required to have their tags validated on Fort Hunter Liggett prior to leaving.
- (4) Due to military operations and training, the specified season dates within the exterior boundaries of Fort Hunter Liggett are subject to further restriction, cancellation, or may be rescheduled, between August 1 and January 31, by the Commanding Officer.

- (q) [subsection reserved]

(r) Department Administered General Methods Roosevelt Elk Hunts					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)(A) Siskiyou	20	20			Shall open on the Wednesday preceding the second Saturday in September and continue for 12 consecutive days.
(2)(A) Northwestern	15	0	3		Shall open on the first Wednesday in September and continue for 23 consecutive days.
(3)(A) Marble Mountains	35	10			Shall open on the Wednesday preceding the second Saturday in September and continue for 12 consecutive days.

(s) Department Administered General Methods Rocky Mountain Elk Hunts						
Hunt		**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)	(A) Northeastern California Bull	15				The bull season shall open on the Wednesday preceding the third Saturday in September and continue for 12 consecutive days.
	(B) Northeastern California Antlerless		10			The antlerless season shall open on the second Wednesday in November and continue for 12 consecutive days.

(t) Department Administered General Methods Roosevelt/Tule Elk Hunts					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)(A) Mendocino	2	0			The season shall open on the Wednesday preceding the fourth Saturday in September and continue for 12 consecutive days.

(u) Department Administered General Methods Tule Elk Hunts						
Hunt		**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)	Cache Creek					
	(A) Bull	2				The Bull season shall open on the second Saturday in October and continue for 16 consecutive days.
	(B) Antlerless		2			The Antlerless season shall open on the third Saturday in October and continue for 16 consecutive days.
(2)	La Panza					
	(A) Period 1	6	5			Shall open on the second Saturday in October and extend for 23 consecutive days.
	(B) Period 2	6	6			Shall open on the second Saturday in November and extend for 23 consecutive days.
(3)	Bishop					
	(A) Period 3	0	0			Shall open on the third Saturday in October and extend for 9 consecutive days.
	(B) Period 4	0	0			Shall open on the first Saturday in November and extend for 9 consecutive days.
	(C) Period 5	0	0			Shall open on the first Saturday in December and continue for 9 consecutive days.
(4)	Independence					

	(A) Period 2	1	1			Shall open on the first Saturday in October and extend for 9 consecutive days.
	(B) Period 3	1	1			Shall open on the third Saturday in October and extend for 9 consecutive days.
	(C) Period 4	0	1			Shall open on the first Saturday in November and extend for 9 consecutive days.
	(D) Period 5	0	0			Shall open on the first Saturday in December and continue for 9 consecutive days.
(5)	Lone Pine					
	(A) Period 2	1	1			Shall open on the first Saturday in October and extend for 9 consecutive days.
	(B) Period 3	1	1			Shall open on the third Saturday in October and extend for 9 consecutive days.
	(C) Period 4		0			Shall open on the first Saturday in November and extend for 9 consecutive days.
	(D) Period 5	0	0			Shall open on the first Saturday in December and continue for 9 consecutive days.
(6)	Tinemaha					
	(A) Period 2	0	0			Shall open on the first Saturday in October and extend for 9 consecutive days.
	(B) Period 3	0	0			Shall open on the third Saturday in October and extend for 9 consecutive days.
	(C) Period 4	0	0			Shall open on the first Saturday in November and extend for 9 consecutive days.
	(D) Period 5	0	0			Shall open on the first Saturday in December and continue for 9 consecutive days.
(7)	West Tinemaha					
	(A) Period 1	0	0			Shall open on the second Saturday in September and extend for 16 consecutive days.

	(B) Period 2	0	0			Shall open on the first Saturday in October and extend for 9 consecutive days.
	(C) Period 3	0	0			Shall open on the third Saturday in October and extend for 9 consecutive days.
	(D) Period 4	0	0			Shall open on the first Saturday in November and extend for 9 consecutive days.
	(E) Period 5	0	0			Shall open on the first Saturday in December and continue for 9 consecutive days.
(8)	Tinemaha Mountain					
	(A) Period 1	0				Shall open on the second Saturday in September and extend for 16 consecutive days.
	(B) Period 2	0				Shall open on the first Saturday in October and extend for 9 consecutive days.
	(C) Period 3	0				Shall open on the third Saturday in October and extend for 9 consecutive days.
	(D) Period 4	0				Shall open on the first Saturday in November and extend for 9 consecutive days.
	(E) Period 5	0				Shall open on the first Saturday in December and continue for 9 consecutive days.
(9)	Whitney					
	(A) Period 2	0	1			Shall open on the first Saturday in October and extend for 9 consecutive days.
	(B) Period 3	0	0			Shall open on the third Saturday in October and extend for 9 consecutive days.
	(C) Period 4	0	0			Shall open on the first Saturday in November and extend for 9 consecutive days.
	(D) Period 5	0	0			Shall open on the first Saturday in December and continue for 9 consecutive days.
(10)	Goodale					

	(A) Period 1	0	0			Shall open on the second Saturday in September and extend for 16 consecutive days.
	(B) Period 2	0	1			Shall open on the first Saturday in October and extend for 9 consecutive days.
	(C) Period 3	0	1			Shall open on the third Saturday in October and extend for 9 consecutive days.
	(D) Period 4	0	0			Shall open on the first Saturday in November and extend for 9 consecutive days.
	(E) Period 5	0	0			Shall open on the first Saturday in December and extend for 9 consecutive days
(11)	Grizzly Island					
	(A) Period 1	0	6		0	Shall open on the second Tuesday after the first Saturday in August and continue for 4 consecutive days.
	(B) Period 2	0	2		4	Shall open on the first Thursday following the opening of period one and continue for 4 consecutive days.
	(C) Period 3	0	6		0	Shall open on the first Tuesday following the opening of period two and continue for 4 consecutive days.
	(D) Period 4	0	4		2	Shall open on the first Thursday following the opening of period three and continue for 4 consecutive days.
	(E) Period 5	0	8		0	Shall open on the first Tuesday following the opening of period four and continue for 4 consecutive days.
	(F) Period 6	0	0		0	Shall open on the first Thursday following the opening of period five and continue for 4 consecutive days.
	(G) Period 7	0	8		0	Shall open on the first Tuesday following the opening of period six and continue for 4 consecutive days.
	(H) Period 8	0	0		6	Shall open on the first Thursday following the opening

						of period seven and continue for 4 consecutive days.
	(I) Period 9	0	8		0	Shall open on the first Tuesday following the opening of period eight and continue for 4 consecutive days.
	(J) Period 10	3	0		0	Shall open on the first Thursday following the opening of period nine and continue for 4 consecutive days.
	(K) Period 11	0	8		0	Shall open on the first Tuesday following the opening of period ten and continue for 4 consecutive days.
	(L) Period 12	3			0	Shall open on the first Thursday following the opening of period eleven and continue for 4 consecutive days.
	(M) Period 13	0	8		0	Shall open on the first Tuesday following the opening of period twelve and continue for 4 consecutive days.
(12)	Fort Hunter Liggett General Public					
	(A) Period 1	0	0			Shall open on the first Thursday in November and continue for 9 consecutive days.
	(B) Period 2	0	0			Shall open on November 22 and continue for 9 consecutive days.
	(C) Period 3	0	0			Shall open on the third Saturday in December and continue for 16 consecutive days.
(13)(A) East Park Reservoir		2	2			Shall open on the first Saturday in September and continue for 27 consecutive days.
(14)(A) San Luis Reservoir		0	0	5		Shall open on the first Saturday in October and continue for 23 consecutive days.
(15)(A) Bear Valley		2	1			Shall open on the second Saturday in October and continue for 9 consecutive days.
(16)	Lake Pillsbury					

	(A) Period 1		4			Shall open on the Wednesday preceding the second Saturday in September and continue for 10 consecutive days.
	(B) Period 2	2				Shall open Monday following the fourth Saturday in September and continue for 10 consecutive days.
(17)(A) Santa Clara		0	0			Shall open on the second Saturday in October and continue for 16 consecutive days.
(18)(A) Alameda		0	0			Shall open on the second Saturday in October and continue for 16 consecutive days.
(v) Department Administered Apprentice Hunts						
Hunt		**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)(A) Marble Mountain General Methods Roosevelt Elk Apprentice				2		Shall open on the Wednesday preceding the second Saturday in September and continue for 12 consecutive days.
(2)(A) Northeast California General Methods Rocky Elk Apprentice				2		Shall open on the Wednesday preceding the third Saturday in September and continue for 12 consecutive days.
(3)(A) Cache Creek General Methods Tule Elk Apprentice		1	0			Shall open on the second Saturday in October and continue for 16 consecutive days.
(4)(A) La Panza General Methods Tule Elk Apprentice		0	1			Shall open on the second Saturday in October and extend for 23 consecutive days.
(5)(A) Bishop General Methods Tule Elk Apprentice Period 2		0	0			Shall open on the first Saturday in October and extend for 9 consecutive days.
(6)	Grizzly Island General Methods Tule Elk Apprentice					
	(A) Period 1		3		0	Shall open on the second Tuesday after the first Saturday in August and continue for 4 consecutive days.
	(B) Period 2		0		2	Shall open on the first Thursday following the opening

						of period one and continue for 4 consecutive days.
	(C) Period 3		3		0	Shall open on the first Tuesday following the opening of period two and continue for 4 consecutive days.
	(D) Period 4		0		2	Shall open on the first Thursday following the opening of period three and continue for 4 consecutive days.
(7)(A) Fort Hunter Liggett General Public General Methods Apprentice		0	0			Shall open on the third Saturday in December and continue for 16 consecutive days.
(w) Department Administered Archery Only Hunts						
Hunt		**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)(A) Northeast California Archery Only		0	0	10		Shall open on the Wednesday preceding the first Saturday in September and continue for 12 consecutive days.
(2)(A) Owens Valley Multiple Zone Archery Only		3	0			Shall open on the second Saturday in August and extend for 9 consecutive days.
(3)(A) Lone Pine Archery Only Period 1		0	1			Shall open on the second Saturday in September and extend for 16 consecutive days.
(4)(A) Tinemaha Archery Only Period 1		0	0			Shall open on the second Saturday in September and extend for 16 consecutive days.
(5)(A) Whitney Archery Only Period 1		0	0			Shall open on the second Saturday in September and extend for 16 consecutive days.
(6)	Fort Hunter Liggett					
	(A) General Public Archery Only Either Sex			3		Shall open on the last Wednesday in July and continue for 9 consecutive days.
	(B) General Public Archery Only Antlerless		4			Shall open on theTuesday preceding the fourth Thursday in November and continue for 9 consecutive days.

(x) Department Administered Muzzleloader Only Tule Elk Hunts					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)(A) Bishop Muzzleloader Only Period 1	0	0			Shall open on the second Saturday in September and extend for 16 consecutive days.
(2)(A) Independence Muzzleloader Only Period 1	1	0			Shall open on the second Saturday in September and extend for 16 consecutive days.
(3)(A) Goodale Muzzleloader Only Period 1	0	1			Shall open on the second Saturday in September and extend for 16 consecutive days.
(4)(A) Fort Hunter Liggett General Public Muzzleloader Only	0	0			Shall open on the third Saturday in December and continue for 17 consecutive days.
(y) Department Administered Muzzleloader/Archery Only Hunts					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)(A) Marble Mountain Muzzleloader/Archery Roosevelt Elk			5		Shall open on the last Saturday in October and extend for 9 consecutive days.
(z) Fund Raising Elk Tags					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)(A) Multi-zone Fund Raising Tags	1				Siskiyou and Marble Mountains Roosevelt Elk Season shall open on the Wednesday preceding the first Saturday in September and continue for 19 consecutive days. Northwestern Roosevelt Elk Season shall open on the last Wednesday in August and continue for 30 consecutive days. Northeastern Rocky Mountain Elk Season shall open on the

					Wednesday preceding the last Saturday in August and continue for 33 consecutive days. La Panza Tule Elk Season shall open on the first Saturday in October and extend for 65 consecutive days.
(2)(A) Grizzly Island Fund Raising Tags		1			Shall open on the first Saturday in August and continue for 30 consecutive days
(3)(A) Owens Valley Fund Raising Tags		1			Shall open on the last Saturday in July and extend for 30 consecutive days.
(aa) Military Only Tule Elk Hunts					
Hunt		**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**5. Season**
(1)	Fort Hunter Liggett Military Only General Methods					
	(A) Early Season	0	0			The early season shall open on the second Monday in August and continue for 5 consecutive days and reopen on the fourth Monday in August and continue for 5 consecutive days.
	(B) Period 1		0			Shall open on the first Thursday in November and continue for 9 consecutive days.
	(C) Period 2		0			Shall open November 22 and continue for 9 consecutive days.
	(D) Period 3	0				Shall open on the third Saturday in December and continue for 16 consecutive days.
(2)(A) Fort Hunter Liggett Military Only General Methods Apprentice		0	0			Shall open on the third Saturday in December and continue for 16 consecutive days.
(3) Fort Hunter Liggett Military Only Archery Only						
	(A) Either sex			3		Shall open on the last Wednesday in July and

						continue for 9 consecutive days.
	(B) Antlerless		4			Shall open on the last Wednesday in September and continue for 9 consecutive days.
(4)(A) Fort Hunter Liggett Military Only Muzzleloader Only		4				Shall open on the third Saturday in December and continue for 17 consecutive days.

Amendment filed 7/17/2017; effective 7/17/2017

§364.1, Title 14, CCR Department Administered Shared Habitat Alliance for Recreational Enhancement (SHARE) Elk Hunts

- (a) Season: The overall season shall open August 15 through January 31. Individual SHARE properties will be assigned seasons corresponding with management goals.
- (b) Bag and Possession Limit: Each elk tag is valid only for one elk per season and only in the SHARE hunt area drawn, and persons shall only be eligible for one elk tag per season through sections 364 or 364.1.
- (c) Individual property boundaries will be identified in the SHARE application package.
- (d Method of Take: Only methods for taking elk as defined in Sections 353 and 354 may be used.
- (e) Tagholder Responsibilities: See subsection 364(n)
- (f) The use of dogs to take or attempt to take elk is prohibited.
- (g) Applicants shall apply for a SHARE Access Permit, and pay a nonrefundable application fee as specified in Section 602, through the department's Automated License Data System terminals at any department license agent, department license sales office, or online.
- (h) Upon receipt of winner notification, successful applicants shall submit the appropriate tag fee as specified in Section 702 through any department license sales office or online through the department's Automated License Data System.

(i) Department Administered SHARE Roosevelt Elk Hunts					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**(B) Area**
(1)(A) Siskiyou	2	2			Area: The tag shall be valid in the area described in subsection 364(a)(1)(A).
(2)(A) Northwestern	7	20			Area: The tag shall be valid in the area described in subsection 364(a)(2)(A).
(3)(A) Marble Mountain	0	0			Area: The tag shall be valid in the area described in subsection 364(a)(3)(A).
(j) Department Administered General Methods SHARE Rocky Mountain Elk Hunts					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**(B) Area**

(1)(A) Northeast California	0	0			Area: The tag shall be valid in the area described in subsection 364(b)(1)(A).
(k) Department Administered SHARE Roosevelt/Tule Elk Hunts					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**(B) Area**
(1)(A) Mendocino	2	4			Area: The tag shall be valid in the area described in subsection 364(c)(1)(A).
(*l*) Department Administered SHARE Tule Elk Hunts					
Hunt	**1. Bull Tags**	**2. Antlerless Tags**	**3 Either-Sex Tags**	**4. Spike Tags**	**(B) Area**
(1)(A) Cache Creek	1	1			Area: The tag shall be valid in the area described in subsection 364(d)(1)(A).
(2)(A) La Panza	5	10			Area: The tag shall be valid in the area described in subsection 364(d)(2)(A).
(3)(A) Bishop	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(3)(A).
(4)(A) Independence	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(4)(A).
(5)(A) Lone Pine Period 2	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(5)(A).
(6)(A) Tinemaha	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(6)(A).
(7)(A) West Tinemaha	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(7)(A).
(8)(A) Tinemaha Mountain	0				Area: The tag shall be valid in the area described in subsection 364(d)(8)(A).
(9)(A) Whitney	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(9)(A).
(10)(A) Goodale	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(10)(A).

(11)(A) Grizzly Island	0	0		0	Area: The tag shall be valid in the area described in subsection 364(d)(11)(A).
(12)(A) Fort Hunter Liggett	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(12)(A).
(13)(A) East Park Reservoir	1	1			Area: The tag shall be valid in the area described in subsection 364(d)(13)(A).
(14)(A) San Luis Reservoir	2	3			Area: The tag shall be valid in the area described in subsection 364(d)(14)(A).
(15)(A) Bear Valley	1	1			Area: The tag shall be valid in the area described in subsection 364(d)(15)(A).
(16)(A) Lake Pillsbury	0	0			Area: The tag shall be valid in the area described in subsection 364(d)(16)(A).
(17)(A) Santa Clara	0				Area: The tag shall be valid in the area described in subsection 364(d)(17)(A).
(18)(A) Alameda	0				Area: The tag shall be valid in the area described in subsection 364(d)(18)(A).

Amended 7/17/2017; effective 7/17/2017.

Appendix 6 – 2018 Elk Tags Issued and Harvested on PLM Ranches in the Northwestern Elk Zone

PLM Name	County	Authorized Harvest	Elk Tags Issued		Harvest	
			Bull	Antlerless	Bull	Antlerless
Alexandre Ecodairy Farms	Del Norte	2 bull elk and 4 antlerless elk	2	4	2	4
Big Lagoon	Humboldt	4 bull elk and 2 antlerless elk	4	2	4	2
Cottrell Ranch	Humboldt	12 deer of which no more than 10 may be antlerless deer, 1 bull elk, and 1 antlerless elk	1	1	1	1
Hunter Ranch	Humboldt	20 deer of which no more than 5 may be antlerless deer and 1 bull elk	1	0	1	0
Klamath PLM	Humboldt	2 bull elk and 2 antlerless elk	2	2	2	1
Redwood House Ranch	Humboldt	20 buck deer forked horn or better and 1 bull elk	1	0	0	0
Smith River	Del Norte	4 bull elk and 6 antlerless elk	4	6	3	5
Stover Ranch	Humboldt	4 bull elk and 2 antlerless elk	4	2	4	1
Wiggins Ranch	Humboldt	2 bull elk and 2 antlerless elk	2	2	2	2
		Totals	**21**	**19**	**19**	**16**

Appendix 7. Section 555, Title 14, CCR

§ 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.

Note: Authority cited: Section 1575, Fish and Game Code. Reference: Sections 67 and 1575, Fish and Game Code.

Appendix 8. Responses to Comments on the Proposed Project

Comments received regarding the Draft Supplemental Environmental Document for Elk Hunting (DSED)

A. **Lori L. Cowan, County of Del Norte Board of Supervisors – Letter dated March 26, 2019**

1. **Comment:** "Following a thorough review of the DSED, the County supports Alternative 2 which calls for increasing the elk tag allocation by 60 for 2019. The findings made in the DSED validate through scientific research that an increase in 60 tags will not detrimentally impact the Roosevelt elk statewide."

   Response: Comment noted.

2. **Comment:** "We believe that the "Elk Pop" computer model runs used to calculate changes in herd characteristics based on various harvest rates is flawed in that the survival rate used for calves at 40% is well below what current Department research for the last three years as found in the County and Region. In particular, the County points to studies on private/publics lands by Department Biologist Carrington Hilson documenting calf survival rates to be 99%. Clearly, the difference between the two survival rates would account for a significantly higher population of Roosevelt elk than the model projects."

   Response: Elk Pop is a microcomputer-based model developed by the Department to predict changes in herd characteristics (e.g. total population size; age and sex ratios) in response to different harvest alternatives. Key inputs to the model include elk population size, age and sex ratios (which are based on observed calf to cow and bull to cow ratios), and calf survival. Calf survival represents a predicted recruitment rate of yearlings into the population, as expressed per 100 cows observed and can be highly variable from year to year and by location based on numerous environmental factors. For the purposes of evaluating the different harvest strategies over the ten years evaluated in the model, a more conservative calf survival rate of 40% was used rather than a potential maximum calf survival rate. The Department acknowledges that some members of the public consider the maximum calf survival (recruitment) rate used in the modeling may be conservative but believes it is more representative over time. As additional data are collected and our understanding of calf survival in this area improves, that input can be modified in future modeling efforts. The Department also agrees that greater calf survival (recruitment) rates are suggestive of more rapid population growth and can produce elk population numbers significantly larger than those predicted by the Elk Pop model.

3. **Comment:** "As residents, agricultural businesses, law enforcement agencies and the County have observed, there is a growing issue with elk-vehicle conflicts.

Traffic collision data (attached) provided by the California Highway Patrol to the Del Norte Farm Bureau shows a growing increase in conflicts between vehicles and elk. This does not account for unreported collisions or multiple elk involved in a single incident. The safety of our local roads and highways are a major priority to the County and we ardently believe that proper management of the population will result in fewer traffic collisions, including the Department working with Caltrans to provide migration corridors for the safe crossing by elk on our State Highways."

Response: The Department agrees that elk-vehicle conflicts are an important issue. The North Coast is one of the Department's highest priorities in response to the U.S. Department of Interior Secretarial Order 3362 regarding wildlife habitat connectivity. The Department will analyze existing and collect additional data to work with CalTrans on the development of crossings to improve movement of elk while significantly reducing vehicle conflict. As elk populations continue to grow and expand, the potential for vehicle collisions also increases. Specific management objectives identified in the North Coast Roosevelt Elk Management Unit (EMU), as well as other EMUs, described in the 2018 Elk Conservation and Management Plan (Management Plan) involve working with CalTrans to reduce vehicle collisions along highways. As discussed in the DSED, the Department and the Commission do not believe vehicle-caused mortality has a significant impact on either statewide or localized elk populations. There is no indication in available data that vehicle-caused mortality is significant. Additionally, hunting in areas where elk are commonly found on roads may also help reduce elk-vehicle conflicts.

4. **Comment:** "The County supports any alternative management which would include separating the Northwestern Elk Zone in order to ensure tags are targeted to areas approaching or exceeding a carrying capacity. The County continues to support the Department's Cooperative Hunt Program, SHARE Program and PLM Program which allows focused elk harvest restricted to specific ranches or farms rather than across the entire hunt zone. While the Cooperative Hunt Program, SHARE Program and PLM Program allows the Department a more systematic approach to elk management, the County strongly believes that the ability to request and obtain a depredation permit needs to remain as a management tool available to the Department and landowners should more localized conflict continue with livestock and/or destruction of private property."

   Response: The Department's Management Plan contains management goals and objectives for the North Coast Roosevelt EMU (Del Norte, and most of Humboldt counties). Goals of the EMU include, but are not limited to, improving habitat and increasing elk on public lands, and to alleviate depredation. This EMU plan is considered a placeholder and starting point to initiate work with local

stakeholders to develop a refined plan for the unit which could involve establishing separate EMUs for Del Norte and Humboldt counties or multiple hunt zones. There are no current plans to eliminate the availability of depredation permits as a management tool. Comments related to the issuance of depredation permits are outside the scope of the DSED.

B. **Rob Miller, Del Norte County Farm Bureau – Letter dated April 1, 2019**

1. **Comment:** "The Del Norte County Farm Bureau (DNCFB) is writing in support of increasing the tag quota range using Alternative 2 (60 tags) for the Northwestern Elk Zone. The DNCFB believes by using the new models and data from the Pittman-Robertson Dingell-Johnson funded project, instead of Elk Pop, that our Humboldt/Del Norte unit will not be affected with the ability to meet the statewide objective to increase populations by ten percent. The Draft Supplemental Environmental Document (DSED), states our current populations size is 1,600 and carrying capacity is estimated at 1,760."

   Response: Comment noted.

2. **Comment:** "The 1987 Elk Pop computer model the State used for this proposed project and alternatives calculated maximum calf survival rate at 40% while Ann Hilson, California Fish and Wildlife, assessed an annual 2017 calf survival rate of .998 % for the Humboldt/Del Norte unit (Pittman-Robertson Funds). The elk surveys by your department (collared) since 2016 shows a growing population (page 22, DSED). The main objective of the Pittman-Robertson Wildlife Restoration Act funds was to provide the North Coast with research efforts focusing on elk population parameters for management and conservation planning. We feel your Elk Pop model is out dated and not applicable."

   Response: (also see response A. 2. above regarding calf survival). Models are an important tool used in wildlife management to analyze, understand and predict potential outcomes of complex interactions of the natural environment. Simulation modeling, in which the dynamics of a population are mimicked through tracking of birth and death rates, is useful in wildlife management for exploring/predicting population responses to changes in management strategies such as hunting. A fundamental assumption of the Elk Pop model is that calf survival is a function of population density (i.e. that calf survival/recruitment rates decrease as density increases; and conversely, calf survival/recruitment rates increase as density decreases). This compensatory response is a common assumption of stock recruitment models. The Department has used Elk Pop for over 25 years to predict potential changes in herd characteristics that can result from various harvest alternatives. Reliability of model predictions can be influenced by the quality/reliability of input data; thus, post-hunt monitoring to determine actual effects of the selected alternative is important. Stock recruitment models continue to be useful in predicting changes that might result

from various harvest alternatives. As indicated in the Department's Management Plan, ongoing monitoring of age and sex ratios as well as total population numbers is an important management objective, particularly where hunting occurs within the EMU.

3. **Comment:** "The Department's management objective for most hunted populations is to maintain at least 15 bulls per 100 cows. The ratio from GPS collared counts show cow ratio has increased from 21 to 31 bulls to 100 cows."

   Response: The Department's Management Plan specifies bull to cow, calf to cow, and population size objectives for each EMU in California. For the North Coast EMU (Northwestern hunt zone), objectives include maintaining at least 15 bulls per 100 cows, with a total population of 1300-4000 elk. Another objective (Objective 1.2) includes a population increase of at least 10% in areas where human conflicts are expected to be minimal.

   The Department's recommended proposal to increase the number of tags by 20 is consistent with the objectives listed above. Analyses of increased harvest and reduced harvest alternatives are also consistent with these objectives. However, the reduced harvest alternative would not likely help to reduce conflicts on private property. The Department has evaluated anticipated effects of the proposed project and its alternatives. In reaching a decision, the Commission may consider recommendations from the Department as well as members of the public.

4. **Comment:** "The available elk habitat on public lands in Del Norte County are very small. There are several herds located on the north side of the Smith River with no available public land habitat. On the South side of the Smith River, the California Fish and Wildlife lands are not suitable as elk habitat. Habitat has not been addressed in years and it is overgrown with scotch broom, tansy ragwort and other invasive species."

   Response: Comment noted. The Department's Management Plan specifies objectives for each EMU in California. For the North Coast EMU, Objective 1.3 specifies seven actions to enhance or increase elk habitat by at least 5% by 2028. The Department will evaluate its holdings and work with other public land managers for opportunities to enhance and restore habitat suitable for elk. Additionally, as discussed in the DSED, the proposed increase in hunting activity is not anticipated to have a significant impact on elk habitat.

5. **Comment:** "In order to meet objective 4.1 in the Elk Management Plan by 2023 (reduce human-elk conflict on private property by at least 25%), we need to increase the tag allocations."

   Response: Comment noted. The proposal involves increasing the tag quota by 20 for the North Coast EMU (Northwestern Hunt Zone). While the Department

believes a potential increase by 60 tags in the Northwestern Hunt Zone would not result in significant population effects, the model results showed potential to limit population growth toward the end of ten years. The Department will evaluate opportunities to further modify tag allocations based on analysis of additional data from the ongoing monitoring program. The Department recognizes significant increases in landowner conflicts and property damage in this zone and looks forward to working with stakeholders over the next several months to identify additional opportunities.

6. **Comment:** "The DSED states the number of elk killed by vehicles is not well documented. The DNCFB was able to receive numbers of vehicles vs. elk traffic collisions from 2015 to 2019 through our local California Highway Patrol (attached). Also, the Department of Transportation (Cal-Trans) provided the information to the California Action Plan, (CAP) Implementation of Department of the Interior Secretarial Order 3362, listing a total number of accidents at 148 between January 2005 to June 2015. This information is well documented. The CAP document states the North Coast unit was reported as having the third highest density for wildlife-vehicle conflict (attached)."

   Response: The Department agrees that elk-vehicle conflicts are an important issue. The North Coast is one of the Department's highest priorities in response to the U.S. Department of Interior Secretarial Order 3362 regarding wildlife habitat connectivity. The Department plans to analyze existing and collect additional data to work with CalTrans on the development of crossings to improve movement of elk while significantly reducing vehicle conflict. As elk populations continue to grow and expand, the potential for vehicle collisions also increases. Specific management objectives for the North Coast, as well as other EMUs, identified in the Management Plan involve working with CalTrans to reduce vehicle collisions along highways. Although public safety and loss of elk due to vehicle collisions are an important concern, analysis of survey data and population demographics over the past three years suggests a healthy and growing population. The Department and the Commission do not believe vehicle-caused mortality causes a significant impact on statewide or localized elk populations.

7. **Comment:** "The DNCFB and landowners have submitted numerous letters over time supporting the separation of the Humboldt/Del Norte unit due to areas that are exceeding carrying capacities. Del Norte County needs their own monitoring management so California Fish and Wildlife can make decisions based on real numbers for our area. The CAP document encourages the department to achieve a robust and well distributed elk population in areas where elk depredation conflicts are minimal. As stated, 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. Management actions should facilitate natural dispersal or

through translocations to reestablish elk where conflicts will be minimal. The dairy, lily and beef ranches in Del Norte County have lost thousands of dollars in lost feed and damages due to providing elk habitat where the elk are not desired."

Response: The Department's Management Plan contains management goals and objectives for the North Coast EMU (Del Norte, and most of Humboldt counties). Goals of the EMU include, but are not limited to, improving habitat and increasing elk on public lands, and to alleviate depredation. However, this EMU document is considered a placeholder and starting point to initiate work with local stakeholders to develop a refined plan for the unit which could involve establishing separate EMUs for Del Norte and Humboldt counties, or multiple hunt zones. Well managed public hunting programs are a valuable and important tool that can help reduce rates of depredation. Programs such as SHARE that offer incentives to landowners to allow public access generate important tag revenue for conservation efforts such as habitat enhancements on public lands.

C. **Phoebe Lenhart – E-mail dated April 3, 2019**

1. **Comment:** "'ELK POP'. Four years ago I wrote to Joe Hobbs (DFW) and questioned the DFW's use of a 1987 computer model by Smith and Updike (pg. 21). This computer model program is valid for only "2-10 (at the maximum) years". Today, over 30 YEARS LATER, the DFW/FGC continue to generate "fake news" based upon these "fake figures". I think this is appalling and is NOT acceptable. In my opinion, all the "computer model runs" have no credibility, along with the rest of the DSED. Given the above, it appears to me that the DFW/FGC cannot make any legitimate claims about the population of the Roosevelt or set any responsible hunting quotas using this obsolete "computer model". This is the 21st Century, in case the DFW/FGC are not aware of the progress in technology.

   I think the DFW/FGC will have much to learn if they would read the reports on the Roosevelt elk researched by the Redwood National and State Parks (RNSP). The RNSP conduct authentic research that is professional."

   Response: (also see responses A. 2. and B. 2. above regarding the Elk Pop model). While the Department has used the Elk Pop model for over 25 years as a tool to help predict changes in herd characteristics that might result from various harvest alternatives, it is important to note that age and sex ratios are the primary inputs to the model and that these are based on observed bull to cow and calf to cow ratios obtained from composition counts throughout the EMU from 2016-2019. The model runs produce the predicted population response over a ten year period of various harvest alternatives; this allows the Department to evaluate the prolonged effects of various harvest alternatives. However,

harvest levels may be adjusted annually (through the Commission's regulatory process); additionally, significant changes in observed population parameters (e.g. total population size, calf to cow and bull to cow ratios) can provide additional information to evaluate/adjust existing harvest levels.

The Department is aware of advances in computer modeling techniques. The existing Elk Pop model is simple and flexible; in the past it has been of great utility in predicting results of various harvest scenarios.

The Department has collaborated with Redwood National and State Parks as well as Humboldt State University to monitor elk population numbers within the Northwestern EMU for over 30 years. Both the Department's Management Plan and DSED have discussed the difficulties and limitations related to elk population monitoring efforts within closed canopy cover. Despite these difficulties/limitations, the Department believes that elk populations are growing and expanding their range within the EMU.

2. **Comment:** "POPULATION OF THE ROOSEVELT ELK IN THE NORTHWEST ZONE. Given the above (#1), the "fake news" and the "fake figures" (based on a computer model that is over 30 years beyond its suggested use), it is obvious to me why I consider the DFW/FGC's DSED fallacious. The DFW/FGC report that there are 1,600 Roosevelt elk (pg. 22), this may be nothing more than a concocted number with no validity.
Again, I refer the DFW/FGC to read the relevant research done by the RNSP."

   Response: The Department's comprehensive elk monitoring program is in its third year of survey and data analysis. Population data collected and analyzed over the survey period to date include minimum counts (direct counts of individuals in a geographic subset of the population's range) and composition counts (counts of bulls, cows and calves). Analysis of data collected in these initial efforts suggests a healthy and growing population. Direct counts conducted from 2016 to 2017 resulted in a minimum count of 990 elk in 22 distinct groups. Preliminary results of 2018 surveys show a minimum count of 1,075. Tracking elk movements over the past two years using GPS collars, data from composition counts, and documentation of calf survival also suggest a ten percent increase in the total number of elk in the Northwestern elk hunt zone. This represents numbers actually seen and does not reflect animals in areas that are inaccessible or unobservable due to closed canopy cover conditions discussed previously. Based on evaluation of these data, the Department has determined a reasonable minimum population estimate of 1,600 elk for the EMU.

3. **Comment:** "CULLING OF ROOSEVELT ELK BULLS. The DFW/FGC recommends maintaining a ratio of 25 bulls for every 100 cows (pg. 24). The scientific community considers this to be a minimum ratio of bulls for every 100 cows. BUT, the DFW/FGC contradicts their own recommendations and reduces the number of bulls (for 100 cows) to 15 in the Northwest zone!!! The DFW/FGC

provides no scientific research behind their decision. I have spoken to reputable biologists who state that a ratio of 15 bulls for every 100 cows is NOT SUSTAINABLE!!! Please provide an explanation to myself and the public for your digression.

Please note, the DFW/FGC does not appear to value the "mature" bulls for their survivorship. Rather than protect the older bulls, with the largest racks, the DFW/FGC condescend to the "trophy hunters". I believe this is contrary to Darwin's theory of natural selection and is another example of poor stewardship by the DFW/FGC."

Response: (also see response B. 3. above regarding herd objective ratios). Minimum objective bull to cow ratios for each EMU are specified in the Department's Management Plan. Without providing reference sources, the commenter asserts the scientific community considers 25 bulls to 100 cows as a minimum ratio, and further asserts that a ratio of 15 bulls per 100 cows for the Northwestern EMU is unsustainable. It is important to note this a minimum objective. This ratio is also fairly common and consistent with bull to cow objectives for other states.

Based on data from field observations, even with current harvest conditions and increased hunter success, the bull to cow ratio for the Northwestern EMU has increased to 31 bulls per 100 cows. Under the existing conditions as well as the proposed project, the increased alternative and the reduced harvest alternative, the predicted bull to cow ratio does not decline significantly and is likely to remain well above the Department's minimum objective bull to cow ratio for the EMU. Nevertheless, the Department will continue to monitor both hunter success and the age of bulls taken by hunters within the Northwestern EMU for significant changes. Data over the last five years from hunter harvested bulls shows every age class represented, from one to ten years with an average age of six. This indicates a healthy distribution of all age classes in the population (Department's Management Plan, Appendix E).

4. **Comment:** "CALF MORTALITY. The DFW/FGC claim that calf mortality is "low" (pg. 19). This is NOT agreed upon by reputable biologists. Their research indicates that Roosevelt elk mortality rates are "high". Refer again to the above (#1)."

   Response: (also see responses A. 2., B. 2., and C. 1. above regarding the Elk Pop model and calf mortality). As included in the DSED, data from the 58 calves collared from 2017 to 2018 to investigate calf survival indicated that survival was high. Initial analysis of those data suggest calf survival could be as high as 80%. The DSED also discusses compensatory response in relation to the Stock-Recruitment model and its fundamental assumption that calf survival is a function of population density.

The Department's estimate of maximum calf survival (expressed as 40 calves per 100 cows for the Northwestern EMU), represents a maximum recruitment rate for the EMU. The observed calf to cow ratio for the EMU is approximately 32 calves per 100 cows and can vary from year to year. Other EMUs in California with a higher estimate of calf survival are associated with observed calf to cow ratios that are correspondingly higher. Nevertheless, with an increase in the tag quota for the Northwestern EMU by 20 tags (as proposed), the Department believes calf production/recruitment will increase slightly to replace additional elk removed through hunting. Ongoing monitoring efforts will also assess response to inform adjustments in future years as needed.

5. **Comment:** "PROJECTIONS. The DFW/FGC present SPECULATION in this DSED (pg. 6) in the form of "alternatives". The DFW/FGC select arbitrary numbers of increases by 10, 20 or 60 tags. It sounds to me that the DFW/FGC are treating the management of the Roosevelt elk as nothing more than a crapshoot. I believe that the hunting allowance is NOT determined by "fake news" and "fake figures", but done by scientifically documented research about what is good stewardship for the herds."

   Response: The Department's comprehensive elk monitoring program in this area is in its third year of survey and data analysis. Population data collected and analyzed over the survey period to date include minimum counts (direct counts of individuals in a geographic subset of the population's range) and composition counts (counts of bulls, cows and calves). Analysis of data collected in these initial efforts suggests a healthy and growing population. Direct counts conducted from 2016 to 2017 resulted in a minimum count of 990 elk in 22 distinct groups. Preliminary results of 2018 surveys show a minimum count of 1,075. Tracking elk movements over the past two years using GPS collars, data from composition counts, and documentation of calf survival also suggests a ten percent increase in the total number of elk in the Northwestern elk hunt zone. Based on the analysis and the ongoing monitoring program, the Department is confident in its approach.

   A requirement of the California Environmental Quality Act is to analyze reasonable alternatives to the proposed project. Suitable alternatives should reduce significant environmental impacts, be feasible, attain most of the basic project objectives, and be reasonable and realistic. The Department conducted a public scoping meeting on November 30, 2018 and received public comments before the December 14, 2018 public comment deadline. Based on the Department's understanding of the elk in the EMU and public comments, the Department decided the alternatives were reasonable. All alternatives analyzed are realistic changes to the tag quotas that are feasible and expected to meet most of the project objectives. No alternatives would result in significant environmental impacts. However, the proposed project most fully meets the project objectives.

6. **Comment:** “PLM AND SHARE HUNTS The additional Roosevelt elk, in particular, the mature bulls, killed in the PLM and SHARE programs indicate a tendency for the killing of bulls to be increasing. These programs are very deceiving since the Roosevelt elk killed are reported on separate tables. I would like more transparency within the DFW/FGC by incorporating the PLM and SHARE hunts on the same tables with the general hunt.
Please explain why, in 2018, there were 15 tags issued to kill bulls, BUT 18 were killed (pg. 18)? Please explain.”

   Response: The table on page 18 shows the distribution of all 88 tags issued in the Northwestern elk zone in 2018. There were 15 bull tags and 3 either-sex tags issued in the general tag draws. The 3 either-sex tags successfully harvested bull elk, resulting in 18 total bulls in the general line in the table.

7. **Comment:** “"THE COMMITTEE" The DFW/FGC does not address the composition of "the committee" in the DSED. As I recall, DFW/FGC gave 2 positions to the Rocky Mountain Elk Foundation and no positions were assigned to any conservation groups. I think this is not fair and is biased. I would like one of the Rocky Mountain Elk Foundation's seats to be assigned to a conservation group.”

   Response: The DSED regarding Elk Hunting was prepared by the Department. It is unclear what is referred to with respect to a committee. Perhaps the comment refers to a statement in the Management Plan pertaining to a workgroup convened many years ago, however that meeting is not relevant to the DSED.

8. **Comment:** “BIBLIOGRAPHY Four years ago I wrote to Joe Hobbs (DFW) and shared with him my observation that the bibliography for the "Draft Environmental Document", dated Dec. 8, 2015 was lacking current scientific research and was very obsolete. In comparison, the DSED (dated Feb. 14, 2019) continues to present the same deficiencies and a lack for current research. In particular, there is an obvious omission of the reputable research done by the RNSP. I insist that this change as the RNSP has so much to offer to DFW/FGC about their research done on the Roosevelt elk.”

   Response: The Department has reviewed the Redwood National and State Parks (RNSP) and continues to partner with them on elk management.

   The RNSP 2017 Herd Unit Classification and Management of Roosevelt Elk, June 2018 paper, Appendix A lists cow elk counts for every year from 1998 to 2017. While the count from the last five available years has declined from 303 in 2012 to 249 in 2017, only six of seven herds were counted in 2017. This suggests elk numbers have stayed relatively constant. These numbers also reflect only elk found within the Redwood National and State Parks at the time of survey, not of the entirety of the Northwestern elk hunt zone.

The Department works closely with RNSP staff. RNSP staff have assisted the Department for the past two years in calf and cow captures in the RNSP areas, and both the RNSP and Department staff regularly survey elk in these territories. The Department greatly appreciates the work of the RNSP and plans to continue partnering with them in the future.

9. **Comment:** “The Supporters for Del Norte Roosevelt Elk have been working with the DFW/FGC for over 4 years on behalf of the Roosevelt elk in Del Norte County. I have provided both agencies with relevant suggestions based on scientists' research pertaining to the good stewardship of the Roosevelt elk. Hundreds of thousands of Roosevelt elk were slaughtered by hunters to near extinction around 100 years ago. I am insulted by the DFW/FGC's DSED and suggest that it be re-done without the "fake news" and "fake figures".”

   Response: The decimation and recovery of California elk is well documented and recognized by the Department. It is discussed in the Management Plan and highlights efforts to re-establish elk throughout much of its historic range. As described in the plan and supported with long term monitoring efforts, the recovery of elk throughout their historical range and continued natural expansion has been a tremendous success. The Department will continue to implement a comprehensive monitoring program and use the best available science to inform management recommendations. As discussed in the DSED, the proposed increase in tag quotas will not have a significant impact on the elk population.

D. **Thomas Wheeler, Environmental Protection Information Center and the Friends of Del Norte – E-mail dated April 4, 2019**

1. **Comment:** “The SEIR fails to analyze a reasonable range of alternatives by only considering maintaining the current level of hunting or increasing the total amount of hunting. In this manner, the SEIR is lacking and needs to be amended to consider a true range of alternatives—including alternatives that reduce the total amount of elk tags offered.”

   Response: See response to comment C. 5. The Commission agrees that suitable alternatives should reduce significant environmental impacts, be feasible, attain most of the basic project objectives, and be reasonable and realistic. An alternative to reduce the number of tags was not considered because it would not meet project objectives of conserving elk while providing additional hunting opportunities. Furthermore, analysis of data collected over the past three years suggests a healthy and growing population. Based on evaluation of these data, there is nothing that indicates the need to reduce potential adverse impacts. Should conditions change in the future and the monitoring program show negative changes in population demographics, the Department and the Commission would take appropriate actions.

2. **Comment:** “Hunting, together with predation, can affect herd population dynamics. Wolves have returned to California, although not to the Northwest EMU. It may be a matter of time before wolves return to the area. For example, the first wolf in approximately 100 years traveled through Del Norte County in 2019.

   Wright et al. 2006 show that in a survey of antlerless elk, a large majority of the elk taken were considered to be at a “reproductively prime age.” That is, between the ages of 2-9 years. Wright then goes on to show that in the study, the combined influence of hunters taking out median ages, and predators taking out individuals at either extreme, herd numbers and viability began to decline. Please consider Wright, G. J., Peterson, R. O., Smith, D. W., & Lemke, T. O. (2006). Selection of Northern Yellowstone Elk by Gray Wolves and Hunters. Journal of Wildlife Management, 70(4), 1070-1078 in your final Supplemental EIR.

   As reported by Hebblewhite (2005), wolf presence together with inclement weather (associated with a changing climate) produced more dramatic decreases in elk population growth rate than just inclement weather alone. See Hebblewhite, M. 2005. Predation by wolves interacts with the North Pacific Oscillation (NPO) on a western North American elk population. Journal of Animal Ecology 74:226-233. Further, changing weather can increase wolf predation rates. EPIC and the Department admit uncertainty over how these stressors will impact elk populations in real life. But it is this uncertainty that counsels that more analysis, through a larger range of alternatives, is more necessary to inform decisionmaking.”

   Response: Predation rates on California elk are generally unquantified or unavailable; however based on the best available information, elk continue to increase numerically and expand their range in California. Predators may affect localized populations and the Management Plan indicates more intensive monitoring of mortality factors is warranted. The Department will assess these questions as part of its comprehensive monitoring program. If surveys suggest changes to population demographics such as age class distribution or sex ratios, new harvest strategies can be considered. The Department analyzed a reasonable range of alternatives in the DSED that were feasible and realistic, met most of the project objectives, and anticipated to result in no significant environmental impacts.

3. **Comment:** “The Supplement EIR’s discussion on impacts from vehicle strikes is short and conclusory…The Department does not appear to be aware that increased vehicle strikes, perhaps together with increased poaching, likely caused the extirpation of an important herd of Roosevelt Elk. The Boyes elk were first documented in Boyes Meadows in 1937. By the late 1940s, their population

ballooned to around 100, taking advantage of the newfound forage to jump in size. Over time the population settled; between 1950 to the late 1990s, the population fluctuated between 20-60 individuals. In 1998, there were 30 elk. By 2011, the herd was extirpated.

In 1984, Caltrans began planning for a bypass around the old-growth of the park—today, we call the original road the "Newton B. Drury Bypass." This "improvement" came at a cost. The new road opened in 1992. Construction of the road created meadows and clearings, which were soon utilized by elk. Increased road kill soon followed. In places, the road is quite steep. Cars heading downhill (southbound) may find it difficult to stop or evade elk in the roadway. Similarly, elk may find avoiding humans more difficult. In 2003, Caltrans installed a barrier to separate north and southbound lanes. The barrier, intended to keep cars from cross lanes, was also likely effective in limiting elk mobility, making attempts by elk to evade or avoid vehicles more difficult. Elk and other ungulates have a difficulty assessing vehicle speeds and distance, perhaps making last minute maneuvers, and things that inhibit that flight response, more important. Furthermore, these elk were habituated to humans, and the elk may have had difficulty determining which vehicles detected them and wanted to slow to observe and which vehicles did not detect them or wanted to poach them.

Del Norte County provided records within their letter to the Department containing additional instances of elk strikes known to the county. Please consider these accounts and attempt a more meaningful investigation of potential impacts instead of relying on conclusory statements."

Response: In regard to vehicle incidents, see response to A.3., above. In regards to poaching, the Department has emphasized investigation of elk poaching incidents. It will continue to do so in the future, and will prosecute violators as warranted. Recent provisions of the Fish and Game Code (§ 12013.3) establish fines ranging from $5,000-$40,000 for violations that involve trophy deer, elk, pronghorn antelope, or bighorn sheep. While the Department agrees vehicle collisions and illegal take are important issues that will continue to be addressed, analysis of survey data and population demographics over the past three years suggests a healthy and growing population. This indicates that illegal take and vehicle collisions do not have a significant impact on elk populations either statewide or at a localized level.

4. **Comment:** "The Supplemental EIR appears to downplay the real danger that poaching plays on local elk populations in finding that poaching will not have significant adverse cumulative effects…EPIC agrees with the Department that "[i]llegal harvest of game mammals is difficult to quantify." As one article mentions, there had appeared to be an attempt to hide evidence of poaching. As most wildlife experts agree, most cases of poaching are not discovered and only

one to five percent of poachers are caught. The Department, however, does not appear to be interested and dismisses poaching impacts by concluding, without evidence, that poaching is unlikely to have a significant cumulative effect."

Response: The Department has emphasized investigation of elk poaching incidents. It will continue to do so, and will prosecute violators as warranted. Recent provisions of the Fish and Game Code (§ 12013.3) establish fines ranging from $5,000-$40,000 for violations that involve trophy deer, elk, pronghorn antelope, or bighorn sheep. While the Department agrees that poaching is a very important issue that will continue to be addressed, analysis of survey data and population demographics over the past three years suggests a healthy and growing population. This indicates that illegal take or poaching is not having a significant impact on elk populations either statewide or at a localized level.

5. **Comment:** "EPIC is concerned about the Department's reliance on the "Elk Pop" model, Smith, D. and D. Updike. 1987. Elk Pop, unpublished computer population simulation model. Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814. According to the Supplement, the model was produced by the Department and was released in 1987.

   EPIC is concerned with the Department's reliance on a model completed by itself over three decades ago used to justify the Department's own decision. Additionally, there are other factors that call into question the reliability and integrity of the Elk Pop Model. Based on EPIC's review of multiple scientific databases, it appears that the Elk Pop model was: (1) never been peer reviewed; (2) never validated by on-the-ground counts, or if validated, the data been made available. Given these issues, it is not sound for the Department to be reliant on the Elk Pop model.

   Model results published in the appendix to the Supplement shows the number of elk killed by "non-hunting causes." Presumably, this accounts for all other potential causes of mortality, such as vehicle strikes, poaching, starvation, predation, etc. The model assumes a rate of 23.5% of bulls lost to non-hunting causes and 11.9% of cows. It is not clear where these numbers come from. Again, a lack of validation concerns EPIC. Furthermore, we are concerned that the Department treats these numbers as static, despite a changing world. Assuming that the Department arrived at these mortality rates from observation in 1987, these represent a snapshot of conditions in that year. As the Supplement acknowledges, elk face a variety of population stressors, but that these stressors change from year to year, whether it is drought or poaching. Furthermore, as discussed above, climate change and new predators might increase the nonhunting mortality rate above historic levels."

Response: (also see responses A. 2., B. 2., C. 1., C. 3. and C. 4. above regarding the Elk Pop model). Key inputs to the model include age and sex ratios (which are based on observed calf to cow and bull to cow ratios). Additional estimates of herd size and carrying capacity can be varied based on observation and/or modeling purposes. The DSED reported that nonhunting mortality rates were estimated, and that these estimates were considered valid representations of actual nonhunting mortality rates when the model predicted the observed herd composition ratios (i.e., bull to cow and calf to cow ratios) for 10 consecutive years.

The Elk Pop model has been used consistently for over 25 years to allow for the simultaneous analysis of multiple harvest alternatives. It is also easily adapted to most EMUs throughout the state. However, additional monitoring within each EMU occurs on an ongoing basis. This includes determining hunter success rates as well as age determination of individual elk taken by hunters. The average age of the harvest for the Northwestern EMU from 1989-2016 has not declined and indicates that the majority of bulls and antlerless elk taken by hunters survived through multiple breeding cycles (Department's Management Plan, Appendix E).

Based on the model, there is no anticipated significant impact from an increase in hunting on the elk population, either independently or in combination with other anticipated activities that might affect the elk population. Additionally, the model presents a conservative estimate to accommodate impacts from other stressors, should they be higher than initially anticipated.

E. **Joe Gillespie, Friends of Del Norte – E-mail dated April 4, 2019**

1. **Comment:** A summary of all past elk harvest for the Northwest hunt provided by CDFW is contained in our Appendix A, except that 2018 harvest numbers are given on page 18 of the Document (as total 2018 harvested hunt, PLM, SHARE, General, was: bulls: 45 + antlerless 35 = 80.) As clearly stated on page 6 of the Document, *the baseline or current condition is 2018/2019 for the no project alternative*, which is the harvest of about 80. Yet the Elk pop model run for the no project alternative uses only 65 elk.
   The historic progression of the harvest is summarized:
   2013- total harvest 45
   2014- total harvest 45
   2015- total harvest 68
   2016- total harvest 62
   2017- total harvest 73, and 85 tags were issued
   2018- total harvest 80, and 88 tags were issued
   The Document also fails to provide or analyze the historic information. If it did, we would see that **from 2014 to 2018 CFG allowed the elk harvest to increase by 77%** [(80-45)/45]. Yet during this same time period when the elk harvest nearly

doubled, there were no environmental documents; no actual field elk counts until 2017, and no transparent, coherent historic analysis whatsoever – were ever provided to the public.

Elk population **models** in the Document on pages 58 and 59 show current conditions and the no project alternative, as a **harvest of only 65 elk:** "Appendix 3. Computer Model Runs (Elk Pop) Harvest NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM, SHARE TAGS, 2019 (Combined Harvest for Del Norte and Humboldt cos) Ratio = 37/100/32 - Maximum Calf Survival= 40% THIS PROGRAM CALCULATES CHANGES IN HERD CHARACTERISTICSBASED ON VARIOUS HARVEST RATES. CURRENT CONDITIONS = NO CHANGE. GENERAL, COOP ELK, SHARE AND PLM TAGS TO HARVEST APPROXIMATELY 44 BULLS AND 21 ANTLERLESS ELK" However, the actual current baseline conditions are that for the last two years, there has been a hunt that issues greater than 80 tags and results in a harvest that approaches 80. *Not 65.* There has been a misrepresentation of current baseline conditions in the population modeling documents. This is internally inconsistent, and is confusing as to how the model was manipulated. The Document contains a serious error. Likewise, the proposed alternative is misrepresented: In the population model, page 62, the proposed harvest is stated as approximately 85: "PROPOSED PROJECT: ADD 8 BULL AND 12 ANTLERLESS (SHARE) TAGS TO **HARVEST** APPROXIMATELY 52 BULLS AND 33 ANTLERLESS ELK" The total proposed harvest, as stated on page 18: *The proposed project will result in increasing the total tags to allow removal of up to 108 Roosevelt elk.* The proposed harvest of 108 is significantly larger than the proposed project **model** run of 85. What is alarming is that the models run clearly show that if you run the actual current conditions of a harvest of approximately 80-85, the herds do not grow significantly, but remain stable. The Department of Fish and Wildlife has significantly and incrementally increased elk harvest size since 2014 by 77%, so that the significantly increased harvest belatedly described in this Document – **has already been implemented.** Already implemented – we would underline again – **without** appropriate elk count/population data analysis and without environmental documents. The harvest numbers have increased substantially *every single year* since 2014, without environmental documents and through without a Statewide Management Plan. Current baseline conditions of harvesting 80-85 elk already constitute implementation of a greatly increased harvest. The models show that this amount of harvest, page 62, will result in stable or possibly a slight decrease in herd size. Any harvest above this amount is shown to decrease herd size significantly.

Therefore our organization finds that it cannot support any of the project alternatives, because of the errors in the analysis. Even if we wanted to support the "current conditions/no project" alternative, we could not because it is not clear what number this would be, 65 or 80, and it is not clear what impacts this is

already having or will have in the future. We would like to see further growth in the herds (so that the Roosevelt elk herds re-occupy most of their historic range) based on actual counts or based on a clear, detailed explanation of what the actual counts are; how they are collected, and how population numbers are derived from actual counts. There is no alternative in the Document that allows this. CDFW has failed to provide an alternative which would *decrease* the number of tags issued and elk harvested. The Elk pop model run shows a decrease in the recovering Roosevelt elk herds which is in conflict with the goals of the Statewide Management Plan. This is also in conflict with the desires of the general public.

Response: (also see responses A. 2., B. 2., C. 1., C. 3., C. 4. and D. 5. above regarding the Elk Pop model). While hunter success has increased over time, the Department has not increased the number of tags. The average (mean) annual harvest for the Northwestern EMU from 2013 -2018 was approximately 44 bulls and 21 antlerless elk per year of the 88 total tags issued. This included elk taken through the general (public) drawing, Cooperative Elk Hunting, SHARE, and the PLM programs. Historically, cumulative hunter success has been less than 100%, although annual success can approach 100% in some areas (a comprehensive tabulation of hunter success for the Northwestern EMU can be found in Appendix E of the Department's Management Plan). Thus, to model existing conditions (i.e. the No Change Alternative) the Department assumed a mean annual harvest of 44 bulls and 21 antlerless elk per year, which is based on an overall hunter success from 2013-2018 that was less than 100%. However, to model anticipated effects of the Department's recommended proposal (an increase of 20 tags) as well as the increased (60 tags) proposal and reduced (an increase of only 10 tags) proposal, the Department assumed that any additional tags issued as a result of the Commission's actions would involve a 100% hunter success rate.

The Department believes that elk are continuing to expand their range and increase numerically within the EMU. Additionally, the apparent increase in private property conflicts that involve elk within the Northwestern EMU provides anecdotal information to support this. The Department has counted a minimum of 1,075 elk within the EMU. This represents numbers actually seen and does not reflect animals in areas that are inaccessible or unobservable due to closed canopy cover conditions discussed previously. Based on evaluation of available data, the Department has determined a conservative population estimate of 1,600 elk for the EMU.

As discussed, the DSED describes the Department's recommended proposal to increase the total number of tags for the Northwestern EMU quota by 20 tags for a total of 108. The Elk Pop model predicts that population levels would continue to increase under the proposal over a 10-year period, consistent with the

population objective in the Elk Conservation and Management Plan. Under the increased proposal (60 tags) the model predicts that population growth may be limited over the 10-year period. However, annual monitoring within each EMU occurs on an ongoing basis and harvest levels may be adjusted (through the Commission's regulatory process); additionally, significant changes in observed population parameters (e.g. total population size, calf to cow and bull to cow ratios) can provide additional information to evaluate and adjust existing harvest levels.

2. **Comment:** "The Document fails to document in any way the alleged conflicts between landowners and elk, which are most likely being "reported" to CDFW by larger commercial operations. Document tone is negative about the elk "problem" and repeatedly uses the word "conflict." It is silent on the widespread public interest in the recovery of the elk herds. Nor does it mention the contribution to tourism, on which our regional economies are now heavily dependent."

   Response: The Department has received reports of property damage from landowners for years in parts of Del Norte and Humboldt Counties. The Del Norte County Board of Supervisors and Del Norte County Farm Bureau have also reported incidents to the Department. The Department has a process for responding to complaints and working with reporting parties to address conflicts. The SHARE program is a valuable tool to help address conflict issues in various parts of the state by providing public access to private lands. The proposed program is consistent with the Department's management objective to increase the elk population, and is not anticipated to have a significant impact on the elk population on either a statewide or localized level.

3. **Comment:** "The Document also fails to give even the 2018 or early 2019 elk field counts, thus it is outdated and incomplete. Also, by failing to provide the most recent data CDFW is fragmenting the CEQA process, leaving us wondering when that data will be presented, considered and factored in. Further where is the explanation of how field data is collected? Where is the detailed explanation of how final population numbers are derived from field counts? Certainly this is not in this Document either. We are left to speculate. We are left to take it on faith."

   Response: The Department reports that the north Coast EMU currently contains at least 1600 elk (and likely, much more). Public elk hunting has occurred annually in Del Norte County since 1993, whereas hunting under the PLM program has occurred within the North Coast EMU since 2008. Against this backdrop of carefully regulated elk hunting, available data show that Roosevelt elk numbers both statewide and within the North Coast EMU have increased steadily over time (Management Plan). Data from the 2018/19 field season were unavailable at the time the Supplemental Environmental Document was written. Data from the most recent field season combined with historical data were used to prepare the Supplemental Environmental Document.

4. **Comment:** “Redwood National & State Parks studies do not support CDFW leap of faith in elk population growth projections.”

   Response: See response to comment C. 8.

5. **Comment:** “We have requested in our scoping comments and in comments on the draft Management Plan that Tribal hunting allocations be given the first priority, with free or discounted tags for Tribal members because this is subsistence food, and that Tribal hunts be coordinated with other hunts to ensure that a particular herd is not overly impacted. These comments have never been addressed by CDFW or the Commission.”

   Response: The Department is looking at different options to provide special hunting opportunities such as apprentice, military, tribal, or others. There may be statutory constraints that affect the ability to provide preferential or reduced fee opportunities. Tribes have authority on Tribal lands to manage take by their tribal members as they see appropriate. The Department under its Tribal Communication and Consultation Policy seeks and encourages collaborative relationships with Tribes, including for the co-management of resources such as elk or coordinated hunts. For opportunities not on tribal lands, Tribal members are eligible to apply through the general and SHARE draws to receive elk tags available to eligible resident and non-resident hunters.

6. **Comment:** “The discussion of genetics in the Document on page 23 is too general to be of value. The documents talk about impacts to the statewide gene pool but not to the genetically pure or unique “Redwood elk” as per EPIC’s previous submitted comments and attachments on elk hunts and Management Plan. Attached once again are the genetic studies suggesting that the elk that are hunted in this zone are important because they may be genetically unique. Again they deserve a truly conservative approach, special management and further study. These comments have never been addressed by CDFW or the Commission.”

   Response: The Department is aware of the genetic study looking at the three subspecies of elk within California. The Department continues to identify the genetic makeup from elk herds around the state. Meredith et al. (2007) found pure Roosevelt elk and hybrid (Roosevelt/Rocky Mountain) elk in Siskiyou County. In this study, elk from western Siskiyou County were determined to be pure Roosevelt elk along with those from Del Norte, Humboldt, and Trinity counties, and Jewell Oregon. The Department re-established elk in portions of Trinity and Siskiyou counties by translocating elk from Jewell, Oregon. Elk are capable of moving long distances and migrating and no current barriers exist to prevent their movement across the landscape. Further study of elk genetics, including from additional subgroups, will assist the Department in meeting the objectives identified in the Management Plan.

F. **Jane Gilbert – E-mail dated April 5, 2019**

1. **Comment:** "I thank you for collating the separate Elk Hunt programs' data into an overall tags allotted and numbers killed. Road kills, predation of young, poaching information available should also be included in this number. Each harvest impacts the population numbers of elk and total population is integral to effective management and quotas."

   Response: The document is not intended to provide all information on elk mortality. Detailed information on causes of death for individual animals is not readily available, except in limited circumstances. Estimates are used to account for non-hunting mortality for each zone. The Department understands the importance of mortality factors and includes an objective in the Management Plan to conduct studies to improve our understanding of cause-specific mortality to help inform management. While existing data and information on specific mortality rates may be inconsistent or limited, no evidence exists to suggest that populations are being impacted. While the Department and Commission agree that vehicle collisions and illegal take, as well as other mortality factors, can be important stressors on populations, it does not appear that the cumulative mortality factors are currently having a significant impact on the population. As discussed in the DSED, analysis of survey data and population demographics conducted over the past three years in the North Coast zone suggests a healthy and growing population. The Department will continue to work on development of studies to improve understanding of cause-specific mortality.

2. **Comment: "**My comments primarily apply to the Roosevelt Elk hunt in the Northwest Hunt Zone where I reside. I am disappointed that the Draft is still utilizing the department's 1987 non-peer reviewed computer model for determining tag numbers. Humboldt State University has been collaborating with CDFW for over two years now and estimate a population of 990 elk in the Northwest hunt zone (significantly lower than 1600 as a desired population goal), and Redwood National Park has approximately 20 years of data regarding elk populations in the northwestern hunt area, albeit on lands not available to hunt. However, elk do not remain solely on non hunt properties. It may be possible to run these data through the elk pop computer model and justify or refute the elk pop model's veracity… Here again, the computer model seems unsatisfactory in that it doesn't generate age distributions of populations nor real changes in age distributions over time. "

   Response: (also see responses A. 2., B. 2., C. 1., C. 3. and C. 4., and D. 5. above regarding the Elk Pop model). The Department has collaborated with Redwood National and State Parks as well as Humboldt State University to monitor elk population numbers within the Northwestern EMU for over 30 years. Both the Department's Management Plan and the DSED have discussed the difficulties and limitations related to elk population monitoring efforts within closed

canopy cover. Despite these difficulties and limitations, available data and information indicate elk population growth and range expansion within the EMU. The Department has counted a minimum of 1,075 elk within several portions of the Northwestern EMU. This represents numbers actually seen and does not reflect elk in inaccessible or densely vegetated areas where detection is difficult. Based on evaluation of potential habitat and conditions throughout the unit, the Department has determined a conservative population estimate of 1,600 elk .

3. **Comment:** "I am also disappointed that the draft SEIR doesn't analyze any decreased tag number elk hunt alternatives, just summarily dismisses them. Nor does the SEIR focus on the non-hunting recreational opportunities the elk present for residents, tourists, visitors to the region and that impact on the local economies."

   Response: See responses to comments C. 5. and D. 1.. While non-hunting recreation may not be directly addressed in the analysis, the Department does have objectives to improve recreational opportunities as outlined in the Management Plan. While not explicit in the DSED, there is no reason to conclude that the proposed project will impact recreational opportunities. This is supported through the analysis of survey data and population demographics conducted over the past three years in the North Coast zone which suggests a healthy and growing population.

4. **Comment: "**A literature search shows that previous hunting/predation studies indicate that hunting and predation are not equivalent population controls. With a present absence of significant predators on adult elk, (wolves, grizzlies are two examples), hunters' role can become invaluable in population dynamics. However, without specific tag targets such as predominance on antlerless and spikes, the diseased and the infirmed, hunters' takes can hinder the success of a population. The hunters' demands for antlered elk may negatively impact overall population dynamics."

   Response: Data about predation rates on California elk are limited; however based on the best available information, elk continue to increase in number and expand their range in California. Predators may affect localized populations and the Management Plan indicates more intensive monitoring of mortality factors is warranted.

   Currently, the Department issues antlerless, spike, bull, or either sex tags depending on the management needs of each area. Elk of all age classes and genders are harvested. While bull tags may be issued more frequently than antlerless, no data suggest that a limited harvest of males reduces the reproductive fitness of an elk herd.

5. **Comment: "**Additionally, given the reality of Climate Change and uncertainties there within, increasing the hunting tag allotments without data to support, seems irresponsible to me."

   Response: The Department recognizes the effects of climate change can be significant. The Department utilizes adaptive management to provide a structured process for actions under certain conditions based on the best available science. Monitoring and evaluation of management actions allows for adjustments to management decisions over time as potential elk population stressors are better understood. Fish and Game Code (§ 2076.5) allows adoption of emergency regulations if elk numbers drop drastically. Based on analysis of available data and information showing continued increases in number and geographic extent of elk in California, the Department recommends increasing elk tag allocations.

G. **Marilyn Jasper, Public Interest Coalition- Letter dated May 3, 2019**

1. **Comment:** We fully support comments submitted by Phoebe Lenhard (sic) (4/3/19), Supporters for Del Norte Rosevelt Elk and EPIC (4/4/19). We are very concerned that a ratio of 25 bulls, at a minimum, for 100 cows is recommended by the scientific community, but the DFW/FGC arbitrarily or carelessly recommends a reduction of bulls to 15 per 100 cows. Where is the peer-reviewed, scientific studies to support a 40% increase of bull killing?

   We submit that such a drastic increase in the killing of bulls, is unacceptable. This is exacerbated when coupled with an apparent non consideration or factoring of maiming, wounding, and/or other subsequent lethal injuries created by failed attempts to kill where the animal is not retrieved. DFW/FGC needs to lean toward the Precautionary Principle and err on the side of caution.

   Response: See response to comments B. 3., C. 3., and D. 5.

2. **Comment:** We also agree and support most of the comments submitted by Friends of Del Norte (4/4/19). One notable exception is: In our opinion, no one group, whether it be a nonprofit, religious, spiritual, conservation, environmental, tribal, political, public agency, or any other type of group or organization should ever be granted special privileges, priorities, or preferences over any other individual member of the public. IF tags are to be issued, they should be available to all, whether their intention is to view (nonconsumptive) or to kill (consumptive). Free or discounted tags have no place in protecting and preserving the common good or any other resource held in public trust by DFW/FGC. Whether it's subsistence food, religious food, and/or additional use of any parts of the animal for any type of spiritual ceremony, medicinal purposes, etc., is irrelevant and not the purview of DFW/FGC. As a public agency, DFW/FGC's role is simply to treat everyone equally and to ensure enforcement of regulations for full compliance is applied equally to all.

Should any member of the public wish to be included in a drawing or allocation of a tag, he/she should not have to buy a license to kill in order to do so. A license to view--not kill--should be available for the same nominal fee that is paid by those who choose to enter the drawing/allocation process. No tags or special allocations should ever be "gifted" to any group or individual, regardless of the purpose. Such a process creates an unacceptable perception of questionable practices and/or conflicts of interest.

Response: See response to comment E. 5. Existing law requires that applicants must possess a valid hunting license. Such a change is beyond the scope of the project evaluated in the DSED.

It should be noted, however, that the SHARE program also provides incentives for landowners to provide wildlife viewing recreational opportunities. The Department will continue to identify potential interest of landowners to provide wildlife viewing opportunities. Participation by interested members of the public would require a nominal application fee, and opportunities would be available to any member of the public.

H. **Zack Larsen, County of Del Norte Fish and Game Advisory Commission- Letter dated May 2, 2019**

1. **Comment:** We are writing in support of the Department of Fish and Wildlife (Department) proposal to increase the Northwestern Elk Zone tag quota range for Roosevelt elk by 20 tags, as described in the Department's 2018 Draft Supplemental Environmental Document (DSED). We are also providing comments regarding the Private Lands Management Program and elk relocation strategies that should be part of the Management Plan and DSED.

   Response: Comment noted.

2. **Comment:** Private Lands Management (PLM) Elk Tags: The Department has recommended that the number of PLM tags not exceed 50 percent of the general draw tags (Management Plan). We believe that PLM tags should be well below 50 percent of the general draw. In 2018, the PLM tags accounted for 44 percent of the elk harvested in the Northwest California Zone (DSED). The PLM uses up tags within the Northwestern Elk Zone that would otherwise be available for general draw tags. PLM Bull Roosevelt elk tags often sell for tens of thousands of dollars while a Northwestern Elk Zone tag costs $459.25 for a California resident who successfully draws a tag.

   Though PLM tags will not increase as a result of the proposed modifications to the current elk hunting regulations (2019-2020) we believe the public, particularly local hunters who apply for elk tags, unfairly lose opportunities to draw an elk tag in the northwestern elk zone. We understand that the PLM helps landowners

alleviate depredation, however it does so at the expense of local hunters who likely can't afford to buy PLM tags.

Response: This comment is beyond the scope of the Draft Supplemental Environmental Document. However, the intent of PLM is to encourage conservation and management of wildlife, and not as a program to address landowner conflict.

3. **Comment:** Elk relocation efforts:

   We believe Roosevelt elk-specific relocation criteria, actions and strategies should be called out in the Management Plan and included in the DSED. Relocation of Roosevelt elk does not appear to be part of the Management Plan even though past relocation efforts are responsible for the success of Roosevelt elk in California. We are concerned that the absence of Roosevelt elk relocation strategies in the management plan will preclude any efforts to relocate individual elk and/or herds to Six Rivers National Forest within Del Norte County.

   While the Management Plan states that 60 percent of the North Coast Unit is privately owned, Del Norte County is actually mostly publicly owned land (>80 percent) with US Forest Service (Six Rivers National Forest) as the dominant land manager. Ironically most of the elk in Del Norte County occur on private land and relatively few elk occur on public lands currently open to hunting.

   Elk relocation efforts in the 1940s to early 1960s were thought to be unsuccessful. However it is unknown why. From 1982 through 2000 more than 350 elk were translocated to reestablish populations in Humboldt, Mendocino, Siskiyou, and Trinity Counties (Management Plan). Since 1985, the Department has translocated more than 280 Roosevelt elk to reestablish populations in portions of southern Humboldt, Mendocino, Siskiyou and Trinity counties (DSED SCH 2018112037).

   The Management Plan states that elk in western Siskiyou County showed the same genetic characteristics as those in Del Norte and Humboldt counties and that Interstate 5 may be a physical barrier to eastern elk populations. Therefore relocating animals within Del Norte County would have no effect on inland populations (genetics) in California and Oregon. The Six Rivers National Forest in Del Norte County should be included as priority area for Roosevelt elk relocation effort.

   The North Coast Unit contains the least amount of habitat loss and fragmentation anywhere in the state. According to the Management Plan, Roosevelt elk populations are growing and expanding within the unit and both current population size and biological carrying capacity are likely much larger than estimated (Management Plan). Del Norte County includes abundant opportunities for reestablishing elk in wide, wildlife corridors within large

interconnected regions that can maintain the genetic diversity of healthy populations.

Roosevelt elk are extremely important to Del Norte County for their consumptive, non-consumptive and intrinsic values. The Management Plan, with respect to the North Coast Unit, must favor the sportsman and include the opportunities to capture and relocate animals in order to alleviate road and private land conflicts and future public consumptive and non-consumptive uses.

We look forward to receiving a response from the Fish and Game Commission.

Response: This comment is beyond the scope of the Draft Supplemental Environmental Document. However, these comments will be addressed as the Department works with local stakeholders in revising the North Coast EMU plan.

COUNTY OF DEL NORTE
BOARD OF SUPERVISORS

981 "H" Street, Suite 200
Crescent City, California 95531

Phone
(707)464-7204

Fax
(707) 464-1 165

March 26, 2019

Department of Fish and Wildlife
Wildlife Branch
1812 9th Street
Sacramento, CA 95811

Subject: Comment Letter on Draft Supplemental Environmental Document – Elk Hunting – SCH 2018112037

To Whom it May Concern:

Thank you for the opportunity to comment on the Draft Supplemental Environmental Document (the "DSED") for amendments to the California Code of Regulations related to Elk Management and specifically the tag quota to be authorized in 2019 for Roosevelt elk in the Northwestern Elk Zone. Del Norte County (the "County") has critical concerns of how Roosevelt elk are managed in our County which we have documented in prior letters and public comment to the California Fish and Game Commission (The "Commission") and California Department of Fish and Wildlife (the "Department"). Of major concern are impacts to agricultural operations through loss of grazing pasture, damage to row crops, damage to private property and elk-vehicle conflicts. In light of the data noted in the DSED which conservatively assumes the current population size is 1,600 elk and the carrying capacity is estimated at 1,760 elk within the Northwestern Elk Zone, our level of concern continues to rise as conflicts within our region escalate.

Following a thorough review of the DSED, the County supports Alternative 2 which calls for increasing the elk tag allocation by 60 for 2019. The findings made in the DSED validate through scientific research that an increase in 60 tags will not detrimentally impact the Roosevelt elk statewide. As pointed out in the DSED, there are no significant long-term adverse impacts associated with the proposed project (i.e. increase in 20 tags) or any of the three alternatives. We believe that the "Elk Pop" computer model runs used to calculate changes in herd characteristics based on various harvest rates is flawed in that the survival rate used for calves at 40% is well below what current Department research for the last three years as found in the County and Region. In particular, the County points to studies on private/publics lands by Department Biologist Carrington Hilson documenting calf survival rates to be 99%. Clearly, the difference between the two survival rates would account for a significantly higher population of Roosevelt elk than the model projects.

As residents, agricultural businesses, law enforcement agencies and the County have observed, there is a growing issue with elk-vehicle conflicts. Traffic collision data (attached) provided by the California Highway Patrol to the Del Norte Farm Bureau shows a growing increase in conflicts between vehicles and elk. This does not account for unreported collisions or multiple elk involved in a single incident. The safety of our local roads and highways are a major priority to the County and we ardently believe that proper management of the population will result in fewer traffic collisions, including the Department working with Caltrans to provide migration corridors for the safe crossing by elk on our State Highways.

The County supports any alternative management which would include separating the Northwestern Elk Zone in order to ensure that tags are targeted to areas that are approaching or exceeding a carrying capacity. The County continues to support the Department's Cooperative Hunt Program, SHARE Program and PLM Program which allows focused elk harvest restricted to specific ranches or farms rather than across the entire hunt zone. While the Cooperative Hunt Program, SHARE Program and PLM Program allows the Department a more systematic approach to elk management, the County strongly believes that the ability to request and obtain a depredation permit needs to remain as a management tool available to the Department and landowners should more localized conflict continue with livestock and/or destruction of private property.

To conclude, we believe Alternative 2 provides major benefits and flexibility to provide the Department within the Northwestern Elk Zone the ability to proactively and effectively provide hunting opportunities consistent with the State's Wildlife Conservation Policy and Fish and Game Code section 332 and 1801. Alternative 2 would also effectively account for the increase calf to cow survival rate documented within the Northwestern Zone, by decreasing grazing intensity, and reducing economic impacts related to property damage and loss of pasture. Furthermore, State law has built in protections to ensure that regulations may be adjusted on an emergency basis for catastrophic acts such as an extended drought, major wildlife or spreadable disease which makes the decision to increase the tag limit relatively low risk. The County welcomes the opportunity to review and comment on changes to elk tag quotas moving forward.

Sincerely,

Lori L. Cowan, Chairperson
Board of Supervisors
Del Norte County, California

Del Norte County

-Vehicle vs. Elk Traffic Collisions:

2019

1. 01/11/19- Elk Valley Rd. near Madison Ave. (Report #9120-2019-00015)

2018

1. 04/18/18- SR-197 near Ginny Ln. (197 DN 3.07) (Report #9120-2018-00097)
2. 04/25/18- US-101 near US-199 (101 DN 30.31) (Report #9120-2018-00103)
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5. 09/24/18- US-101 near Lopez Rd. (101 DN 42.19) (Report #9120-2018-00238)
6. 09/27/18- US-101 near Indian Rd. (101 DN 43.82) (Report #9120-2018-00242)
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9. 11/30/18- US-101 near Gilbert Creek (101 DN 45.00) (Report #9120-2018-00333)
10. 12/21/18- US-lOlnear Lopez Rd. (101 DN 42.33) (Report #9120-2018-00361)

2017

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2. 05/02/17- US-101 near US-199 (101 DN 29.97) (Report #9120-2017-00134)
3. 06/14/17- US-101 near Humboldt Rd. (101 DN 23.85) (Report #9120-2017-00179)
4. 07/11/17- US-101 near US-199 (101 DN 30.00) (Report #9120-2017-00214)
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8. 11/10/17- Elk Valley Rd. near East Jefferson St. (Report #9120-2017-00349)
9. 12/11/17- US-101 near Struebing Dr. (101 DN 45.00) (Report #9120-2017-00390)

2016

None.

2015

1. 07/04/15- US-101 near Enderts Beach Rd. (101 DN 24.0) (Report #9120-2015-0008)
2. 07/30/15- US-101 near Enderts Beach Rd. (101 DN 23.85) (Report #9120-2015-0021)
3. 08/20/15- US-101 near Dr. Fine Bridge (101 DN 35.77) (Report #9120-2015-0037)
4. 09/16/15- US-101 near Humboldt Rd. (101 DN 23.85) (Report #9120-2015-0059)
5. 10/01/15- US-101 near Mouth Smith River Rd. (101 DN 43) (Report #9120-2015-0075)
6. 10/20/15- US-101 near Struebing Dr. (101 DN 45.3) (Report #9120-2015-0095)
7. 11/03/15- US-101 near Lopez Rd. (101 DN 42.33) (Report #9120-2015-0118)
8. 12/05/15- US-101 near Wilson Ln. (101 DN 38.25) (Report #9120-2015-0153)

Del Norte
County
Farm Bureau

241 W First St., Suite B, Smith River, CA 95567
(707) 951-0400 DelNorteFarmBureau@charter.net

April 1, 2019

Department of Fish and Wildlife
Wildlife Branch
1812 9th Street
Sacramento, CA 95811

RE: Draft Supplemental Environmental Document regarding Elk Hunting SCH 2018112037 (DSED)

Commissioners,

The Del Norte County Farm Bureau (DNCFB) is writing in support of increasing the tag quota range using Alternative 2 (60 tags) for the Northwestern Elk Zone. The DNCFB believes by using the new models and data from the Pittman-Robertson Dingell-Johnson funded project, instead of Elk Pop, that our Humboldt/Del Norte unit will not be affected with the ability to meet the statewide objective to increase populations by ten percent. The Draft Supplemental Environmental Document (DSED), states our current populations size is 1,600 and carrying capacity is estimated at 1,760.

Some of our concerns with the document are:

- The 1987 Elk Pop computer model the State used for this proposed project and alternatives calculated maximum calf survival rate at 40% while Ann Hilson, California Fish and Wildlife, assessed an annual 2017 calf survival rate of .998 % for the Humboldt/Del Norte unit (Pittman-Robertson Funds). The elk surveys by your department (collared) since 2016 shows a growing population (page 22, DSED). The main objective of the Pittman-Robertson Wildlife Restoration Act funds was to provide the North Coast with research efforts focusing on elk population parameters for management and conservation planning. We feel your Elk Pop model is out dated and not applicable.
- The Department's management objective for most hunted populations is to maintain at least 15 bulls per 100 cows. The ratio from GPS collared counts show cow ratio has increased from 21 to 31 bulls to 100 cows.
- The available elk habitat on public lands in Del Norte County are very small. There are several herds located on the north side of the Smith River with no available public land habitat. On the South side of the Smith River, the California Fish and Wildlife lands are not suitable as elk habitat. Habitat has not been addressed in years and it is overgrown with scotch broom, tansy ragwort and other invasive species.
- In order to meet objective 4.1 in the Elk Management Plan by 2023 (reduce human-elk conflict on private property by at least 25%), we need to increase the tag allocations.

DEL NORTE COUNTY Farm Bureau
241 W First St., Suite B, Smith River, CA 95567
(707) 951-0400 DelNorteFarmBureau@charter.net

5 • The DSED states the number of elk killed by vehicles is not well documented. The DNCFB was able to receive numbers of vehicles vs. elk traffic collisions from 2015 to 2019 through our local California Highway Patrol (attached). Also, the Department of Transportation (Cal-Trans) provided the information to the California Action Plan, (CAP) Implementation of Department of the Interior Secretarial Order 3362, listing a total number of accidents at 148 between January 2005 to June 2015. This information is well documented. The CAP document states the North Coast unit was reported as having the third highest density for wildlife-vehicle conflict (attached).

6 • The DNCFB and landowners have submitted numerous letters over time supporting the separation of the Humboldt/Del Norte unit due to areas that are exceeding carrying capacities. Del Norte County needs their own monitoring management so California Fish and Wildlife can make decisions based on real numbers for our area. The CAP document encourages the department to achieve a robust and well distributed elk population in areas where elk depredation conflicts are minimal. As stated, 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. Management actions should facilitate natural dispersal or through translocations to reestablish elk where conflicts will be minimal. The dairy, lily and beef ranches in Del Norte County have lost thousands of dollars in lost feed and damages due to providing elk habitat where the elk are not desired.

Thank you for the opportunity to comment on the Del Norte/Humboldt DSED. The Del Norte County private landowners desperately need relief.

Sincerely,

Rob Miller, President
Del Norte County Farm Bureau

Cc: Senator Mike McGuire

Attachments:

Ann (Carrington) Hillson email
California Action Plan-Interior Secretarial Order 3362
CHP Vehicle vs. Elk Traffic Collisions
CA Fish and Wildlife Land Ownership-Del Norte vs. Humboldt Maps
Landowner Letters
2018 Wildlife Vehicle Collision Report

Linda Crockett
District Manager
Del Norte Resource Conservation District
241 1st Street, B
Smith River, CA 95567

707 487 7630

On Thursday, March 7, 2019 8:42 PM, "Hilson, Carrington@Wildlife" <Carrington.Hilson@wildlife.ca.gov> wrote:

Linda,
At this point all data we have concerning calf survival is preliminary and only takes into account 2017. This summer we will be able to examine the information from the calves that we marked in 2018.

Looking at only the data from our first year:

> Annual survival was assessed by looking at the effects of time on annual survival (52 weeks) in 2017 using the known fates option in Program MARK (White and Burnham). Using model averaging we obtained an estimated annual survival of 0.998 (SE = 0.004).

This high estimate of juvenile survival, combined with the increase observed in count data, and the high cow:calf ratio, indicates a growing population.

Let me know if you need anything else.

Thanks,
Carrington

Carrington Hilson
Environmental Scientist
California Department of Fish and Wildlife
Email: carrington.hilson@wildlife.ca.gov
Cell: 707-502-4078

Del Norte County Farm Bureau

From: Borges, Rick@CHP <RBorges@chp.ca.gov>
Sent: Friday, March 8, 2013 1:03 PM
To; delnartefarmbureau@charter.net
Cc; Depee, Larry@CH?
Subject Vehicle vs. Elk Traffic Collisions
Attachments: Del Norte County VehvsElk.docx

Ms. Crockett,

I have researched the information you requested and attached are the results regarding vehicle vs. elk traffic collisions from Del Norte County back through the year of 2015. Statistical data regarding collisions obtained'by anyone from the public through the Statewide Integrated Traffic Records System (SWITRS) at iswitrs.chp.ca.gov; however, obtaining the specific animal involved Ina collision requires looking at every collision and determining which type of animal was involved and is not easily available. I hope the information I am providing Is responsive to your request.

Sincerely,

Rick Borges, ID 15557
Officer
California Highway Patrol
Crescent City Area
1444 Parkway Dr,
Crescent City, CA 95531
(707)464-3117
(707)465-6427 fax

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Del Norte County

-Vehicle vs. Elk Traffic Collisions:

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8. 12/05/15- US-101 near Wilson Ln. (101 DN 38.25) (Report #9120-2015-0153)

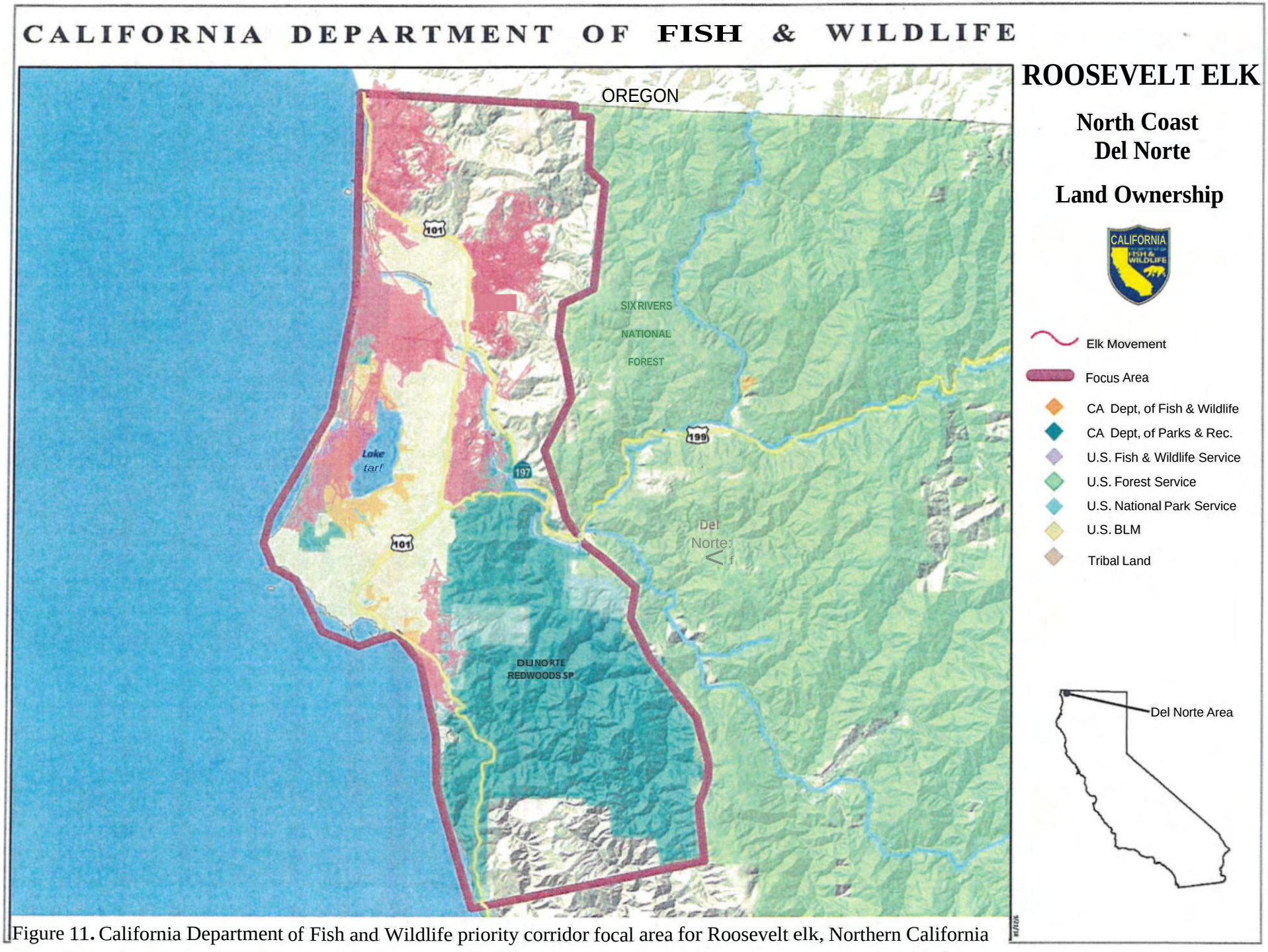


Figure 11. California Department of Fish and Wildlife priority corridor focal area for Roosevelt elk, Northern California Coast Ecoregion, North Coast Province, Northwestern Elk Hunt Zone depicting land management agency jurisdiction.

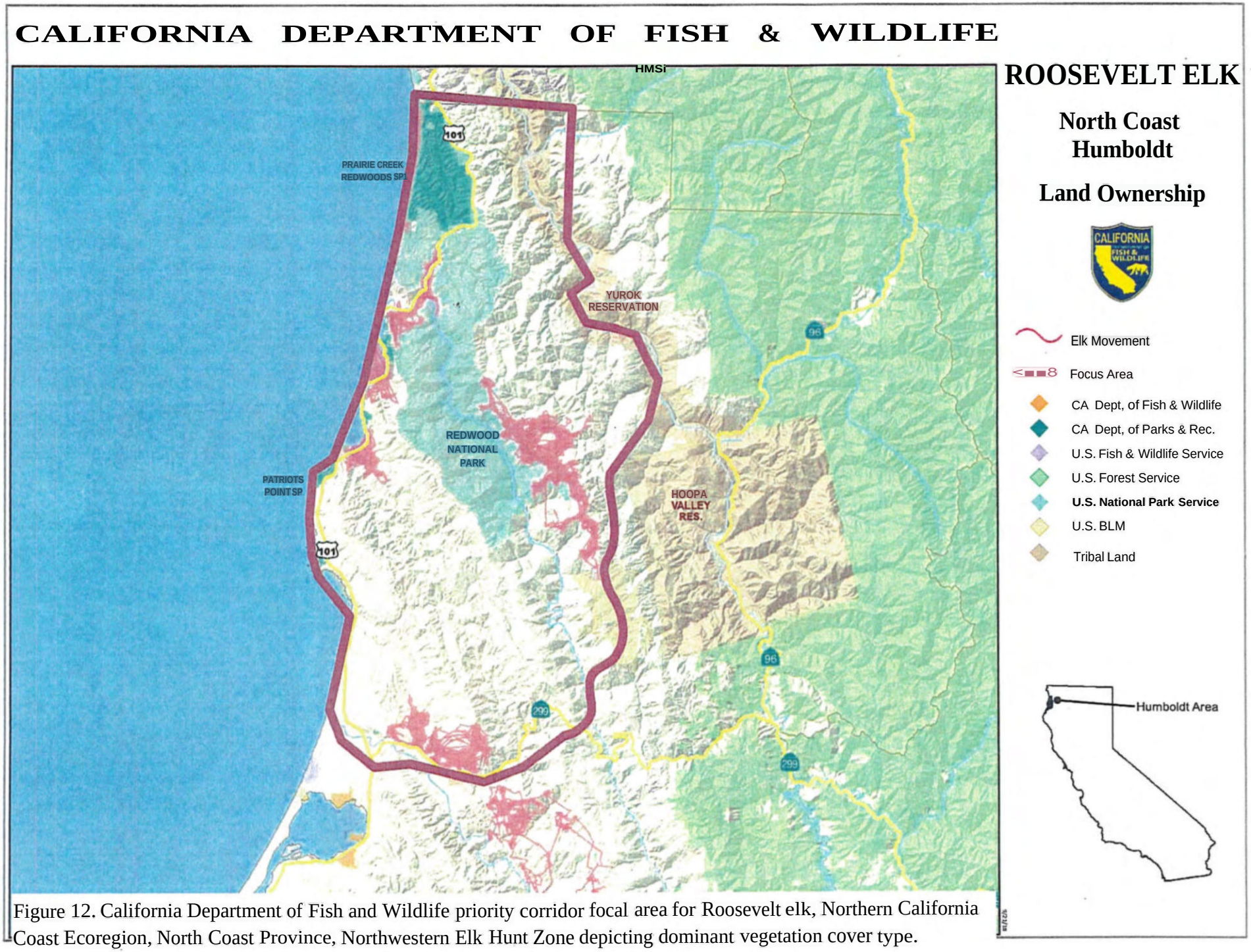


Figure 12. California Department of Fish and Wildlife priority corridor focal area for Roosevelt elk, Northern California Coast Ecoregion, North Coast Province, Northwestern Elk Hunt Zone depicting dominant vegetation cover type.

2018

Impact of Wildlife-Vehicle Conflict on California Drivers and Animals



Fraser Shilling, Ph.D., Co-Director; Cameron Denney, Graduate Student Researcher; David Waetjen, Ph.D., Programmer; Kathryn Harrold, Consultant; Parisa Farman and Paola Perez, Students

9/15/2018

UCDAVIS
ROAD ECOLOGY CENTER

Impact of Wildlife-Vehicle Conflict on California Drivers and Animals

Using observations of reported traffic incidents and carcasses the Road Ecology Center estimates the total annual cost (2017) of wildlife-vehicle conflict (WVC) in California to be at least $307 million, up 11% from 2016. The estimated cost could be as high as $600 million if accidents that are claimed to insurance companies (but un-reported to police) were included. This report includes maps of WVC hotspots, discusses impacts to wildlife and people from WVC, and presents new tools to help organizations and individuals use this information. Projects to reduce WVC can be the most effective of any safety project, with effectiveness often >90%.

Data Sharing/Collaboration: We are always happy to share data and map outputs for people interested in reducing wildlife-vehicle conflict for driver safety and/or wildlife conservation. We receive requests from highway planners, fish and wildlife scientists, students, and non-governmental organizations on a weekly basis. We can typically meet data requests for specific highways, counties, etc., but please keep in mind that this is an unfunded effort of the Road Ecology Center, so we will try to get back to you within a few days.

We have developed a globally-unique web-tool to visualize WVC incidents in CA. It shows WVC hotspot areas throughout CA and a real-time display of WVC events. You can find the website here: https://roadecology.ucdavis.edu/hotspots.

This report provides an overview of wildlife-vehicle conflict (WVC) hotspots on California highways between 2015 and 2017, inclusive, based on a combination of traffic incidents involving wildlife that were recorded by the California Highway Patrol (CHP) and carcass observations reported to the California Roadkill Observation System (http://wildlifecrossing.net/california). Analytical details are provided here and are also available from Fraser Shilling (fmshilling(a)ucdavis.edu) upon request. This report also introduces a new, public web-system that allows the public and transportation agencies to view our scientific results for both legacy/long-term hotspots analysis and real-time tracking of WVC incidents.

Photo acknowledgement

Bighorn Sheep – BighornSheep Institute

Data collection acknowledgements

We appreciate the support from the National Center for Sustainable Transportation (using USDOT funding) for development of the automated wildlife-vehicle conflict hotspot tool described here and elsewhere. This and previous reports and the analyses contained within would not have been possible without the concerted and coordinated efforts of hundreds of volunteer roadkill observers over the last 9 years who contribute to the California Roadkill Observation System (CROS, http://wildlifecrossing.net/california). Through their endeavors, they have so far (9/2018) collected >58,000 observations of >420 species, representing one of the largest and most comprehensive wildlife monitoring programs in California. Their accuracy rates for species identification are >97% and have measurably high locational accuracy (median <±13 meters). For scientific papers describing our roadkill/WVC work, see our published work cited below and at the end of this report (you can paste the "doi" value into a browser and access the papers). The report also benefited from the efforts of many unknown law enforcement personnel who described traffic incidents in enough detail that we can use their observations to help plan for reduced wildlife-vehicle conflict.

CROS is 9-Years Old, Published, & Globally Linked

The Road Ecology Center at UCD is happy to announce that CROS passed its 9th birthday, and during this period, the volunteers have assembled an (ongoing) important dataset which can benefit California wildlife and drivers in the decades to come. We have published our data and findings in the peer-reviewed journals Ecological Informatics, Nature Conservation, and Frontiers of Ecology and Evolution, covering the technical details of the project, including the accuracy of volunteer observations. Finally, we have partnered with other similar systems around the world in the Globalroadkill.net project (http://globalroadkill.net).

Citation for CROS: Waetjen DP and Shilling FM (2017) Large Extent Volunteer Roadkill and Wildlife Observation Systems as Sources of Reliable Data. Front. Ecol. Evol. 5:89. doi: 10.3389/fevo.2017.00089

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The Authors

Fraser Shilling is the Co-Director of the UC Davis Road Ecology Center (http://roadecology.ucdavis.edu) and actively investigates the impacts of transportation systems on natural systems and human communities. He received his PhD in 1991from the University of Southern California in the Division of Biological Sciences. Cameron Denney is a newly-graduated M.Sc. student in Geography at UC Davis and pioneered our new "automated hotspots" web-tool. David Waetjen is lead programmer and web guru for the Road Ecology Center. He received his PhD from UC Davis (Geography) in 2011. He develops web-systems and spatial analyses for wildlife, water, and sustainability applications. Kathryn Harrold is an independent wildlife consultant who is expert in how wildlife interact with roadways and how we can improve roads/highways to protect drivers and wildlife from conflict. Undergraduate and recently-graduated students Parisa Farman and Paola Perez are pursuing careers in wildlife biology and environmental policy.

Contact: Fraser Shilling, Co-Director, Road Ecology Center, UC Davis; fmshilling@ucdavis.edu, 530-752-7859; @roadecology

UC Davis Road Ecology Center
Fifth Annual Special Report on the Impact of Wildlife-Vehicle Conflict (WVC) on California Drivers and Animals

Top 5 Recommendations

1) Systematically collect and share data. The state data assembled here were not collected with the purpose of studying wildlife-vehicle conflict, the volunteer data were. California agencies should collect and share data about wildlife-vehicle conflict to help inform decision-making about this important conservation and safety problem. We are open to partnering with Caltrans, California Department of Fish and Wildlife and others to accomplish this.

2) Require collection and analysis of wildlife-vehicle conflict data for highway/road projects, before they are approved and funded. Transportation and wildlife agency biologists have very little data upon which to base decisions for projects impacting wildlife. Highway projects that are likely to increase WVC can be built because these data are not required.

3) Protect driver safety and wildlife by building WVC-reduction projects. Very few driver safety projects have the overall effectiveness that WVC reduction projects do. There are hundreds of places on state highways and major roads where WVC is a priority, but statewide only 2-3 projects are built per year. Ten times that rate would make a dent in the apparent risk to both drivers and wildlife.

4) Form new partnerships among University and NGO scientists, citizen groups, and local agencies interested in reducing WVC impacts. Local and statewide partners can help advocate for diversion of transportation funds to improve ecological sustainability of transportation.

5) Systematically evaluate how well we are doing with WVC reduction so that we can keep improving. As we plan and build WVC reduction, we should transparently monitor reduced driver injuries and death and use of the structures by wildlife.

Introduction

Using California state data on traffic incidents, the Road Ecology Center has mapped stretches of California highway that are likely to be continuing hotspots for wildlife-vehicle conflicts (WVC). Animals entering roadways are often killed and pose a hazard to drivers, who may collide with the animal, or try to avoid the animal and have an accident suffering vehicle damage, injury, and even death. We estimated the total annual cost to society from >6,600 WVC incidents in California on state highways and a small proportion of major roads to be ~$307 million for 2017, which is an 11% increase compared to 2016. It is important to note that this

report does not cover ALL incidents in California, just the ones reported by the CHP and California Roadkill Observation System (CROS). State Farm Insurance Co. estimated that California had >23,000 claims/year for collisions with wildlife in 2015-2016 (https://newsroom.statefarm.com/download/234883/allstates2015-16deerstats-finalpdf.pdf), which is >3 times the rate we describe here and if included, would result in a total cost to society of ~$600 million/year, which would be similar to costs in other states where total costs have been evaluated (e.g., VA, Donaldson, 2017). In addition, we counted 268 injury accidents in the CHP data we used, which is less than the 383 injury accidents Caltrans reported using CHP data in their press release for the 2018 press release (http://www.dot.ca.gov/paffairs/pr/2018/prs/18pr072.html). So, our study under-estimates the injury portion of the total cost of these types of accidents by ~1/3. This contrast also points to the need for a standardized system for California to collect and report these data. Wildlife populations may suffer significant losses due to collisions and highways with high rates of WVC may cause ripple effects into surrounding ecosystems. In addition, animals are injured during collisions, which is damaging to the animal and potentially traumatic and deadly to drivers.

By identifying stretches of highway where WVC are more likely, the Road Ecology Center is assisting Caltrans and other responsible entities in developing mitigation to protect drivers and wildlife populations. Measures with proven effectiveness include building fencing and over/under-passes along priority highways to allow the safe passage of wildlife across highways and reducing speed limits in protected wildlife habitat. Using CHP data, we have found records of >6,600 reported accidents per year on California highways involving deer and other wildlife. We estimate that there are another few thousand with horses, cows, sheep and goats.

For the third year analyzing CHP data, we have determined rates and locations of both animal carcasses and reported traffic incidents. These incidents could be reports of animals running across the road, collisions with animals (primarily deer), or accidents resulting from people swerving to avoid a collision with an animal in the road. Because deer activity adjacent to highways is correlated with rates of collisions with deer (Donaldson et al., 2015), we included reports of live animals on or near highways (~10% of all reports). Our analyses include identification of geographical hotspots and calculated costs to the public from vehicle damage, injury and even death. This information shows where there are problems and should help in developing safety projects to fix these known problem areas.

The following sections include maps of the distribution of WVC densities, projected costs of WVC and hotspots along state highways and other roadways. The densities of WVC reported are the minimum for each highway segment and do not represent actual rates, which are likely to be much higher. By significantly increasing the systematic treatment of these hotspots and stretches of highway with high rates of collisions, Caltrans and other entities can contribute cost-effectively to driver safety and improve the environmental sustainability of state highways.

Methods

Traffic Incidents

Records of traffic incidents between February 2015 and December 2017 were obtained from state databases of traffic incidents (e.g., emergency responses to crashes), included in our customized "California Highways Incident Processing system" (CHIPs), and coded according to severity of the incident for the drivers/vehicles and for the animals. For this ~3 year period, we separated the ~19,800 records of wildlife-vehicle collisions from the ~2.5 million traffic incidents using customized term queries (e.g., for "deer" AND "buck" AND "doe" AND "fawn"). We reviewed each record for information about fate of the animal, fate of the driver, type of accident (collision vs. swerve), and vehicle damage. Location and date/time information were from the incident record.

The California Roadkill Observation System project (http://wildlifecrossing.net/california) includes past and current participation by over 1,000 volunteer-scientists, including several hundred academic, agency, and NGO biologists and natural historians (Waetjen and Shilling, 2017). More than 56,000 WVC observations were contributed to the website by volunteers between August 2009 and the end of 2017 and by Caltrans Maintenance staff for the period 1987 to 2007. We selected recent observations of large-animal carcasses (last three years) and combined these observations with the CHP crash data. We carefully controlled for duplicates, which were only rarely found because animal carcasses from crash incidents were usually collected fairly quickly by Caltrans.

The carcass observations and traffic incidents were used in a geographic information system (GIS) to identify stretches of highway where WVC occur more frequently (high density) and places where there are statistically-significant clusters of WVC (hotspots; Shilling and Waetjen, 2015). Density was calculated as number of incidents/mile and by using the Kernel Density Estimator (KDE) tool in ArcGIS. Hotspots were identified using the spatial autocorrelation test Getis-Ord for 1 mile state highway segments. Specific methods are included in a methodology appendix. Estimates of costs to society of incidents were calculated using the nature of the incident (e.g., "minor injury") and coefficients for the average cost of these types of incidents used by the US Department of Transportation (USDOT, 2013) and in published literature (Huijser et al., 2009) and technical reports (Cramer et al., 2016).

Major Findings

Statewide Carcass Observations

The maps below show >56,000 observations of animal carcasses on local roads and state highways (Figure 1). These are not the total roadkill that occurred, just the ones that people saw and reported to the California Roadkill Observation System (CROS) between 2009 and 2017.

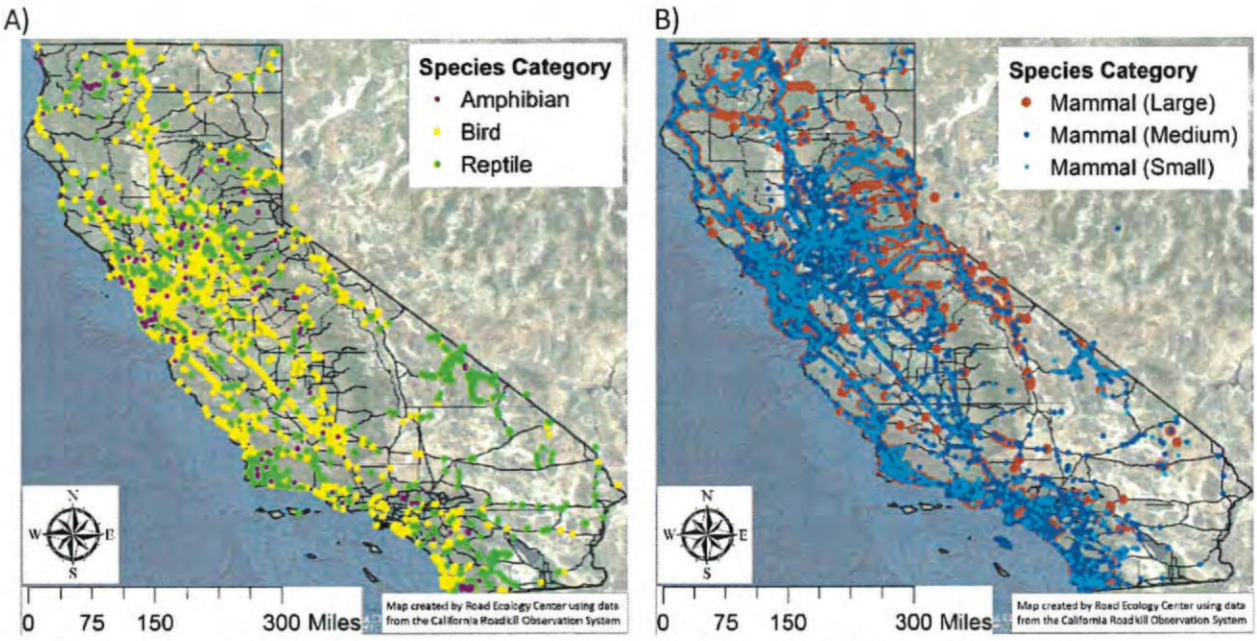


Figure 1. Carcass observations for (A) amphibians, reptiles, and birds; and (B) mammals.

Statewide Highway Traffic Incidents

There were >2 million traffic incidents (of all types) across California reported to the California Highway Patrol in 2015-2017. Of these, about half were collisions and more than 19,800 involved wildlife, including reports of animals standing next to, standing in, or running across roadway lanes, collisions with large animals, and swerving to avoid collisions, resulting in a crash (Figure 2, Wildlife vehicle conflicts). The Fall is the most likely time for WVC, due to increased movement related to mating seasons and seasonal migration.

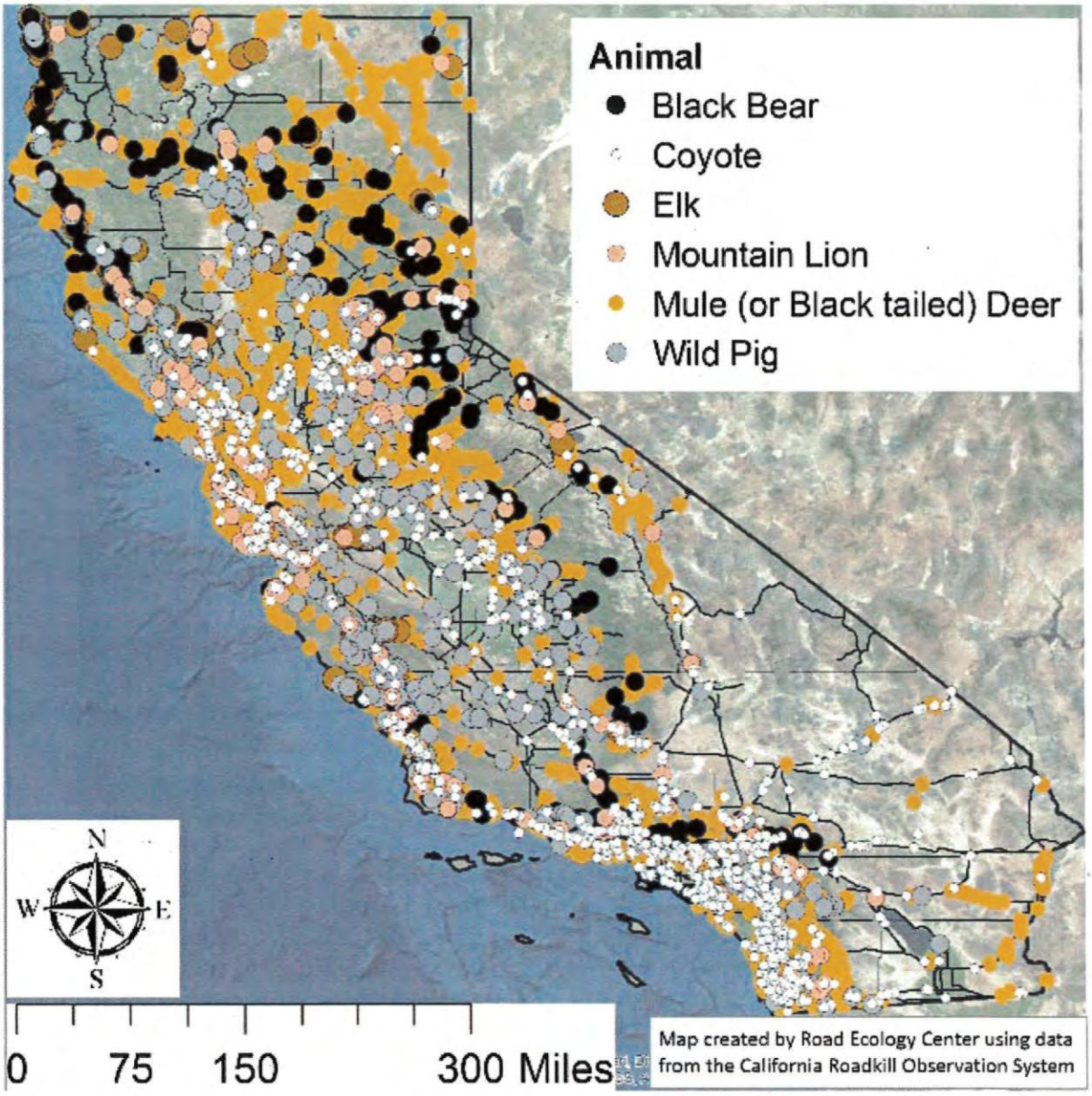


Figure 2. Wildlife-vehicle conflict (WVC) incidents on state highways (2015-2017)

For the first time, we also developed hotspot maps for animal-vehicle-conflict (AVC) involving domestic animals in free range areas, or that have escaped enclosures. Cattle, horse, sheep, pigs and goats can all become involved in conflict incidents with traffic. Because some of these animals can be quite large, larger than most wildlife (expect elk and some bears), collisions with them can be particularly severe for the drivers. We found that AVC occurs everywhere in California (Figure 3) and at fairly high rates.

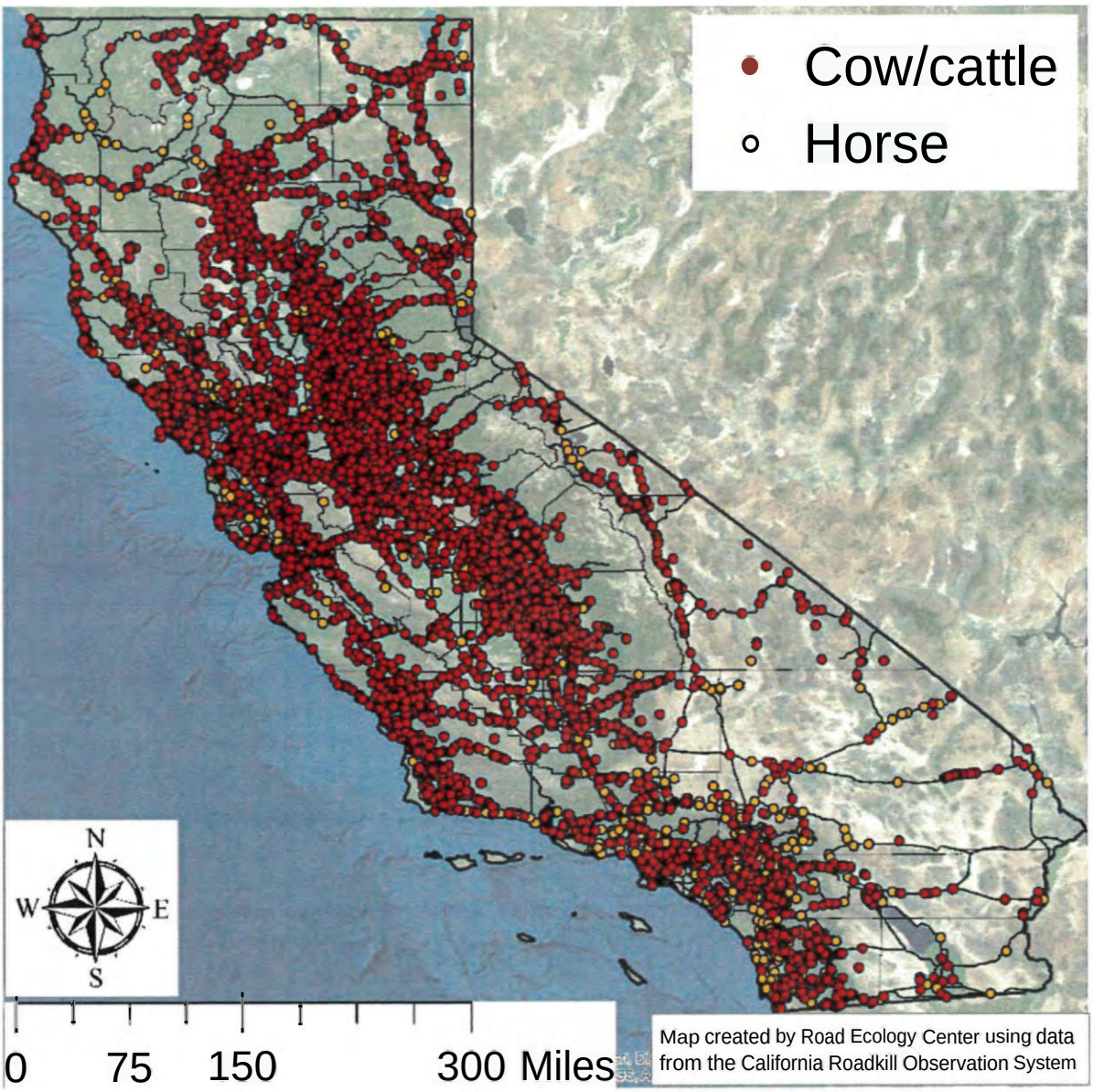


Figure 3. Animal-vehicle conflict involving domestic animals (cows/cattle and horses) for 2015 - 2017.

Statewide Wildlife-Vehicle Conflict Hotspots

Although WVC occur everywhere in California, the highest densities were reported in the San Francisco Bay Area (Caltrans District 4), Sierra Nevada Foothills (Caltrans Districts 3 & 10), North Coast (Caltrans District 1), and parts of the Central/South Coast (Caltrans Districts 5, 7, 11 & 12). These high-density areas are most likely where traffic volumes and wildlife populations are greatest, leading to more conflict. The map below shows the high-density clusters of collisions with large wildlife in California (Figure 4).

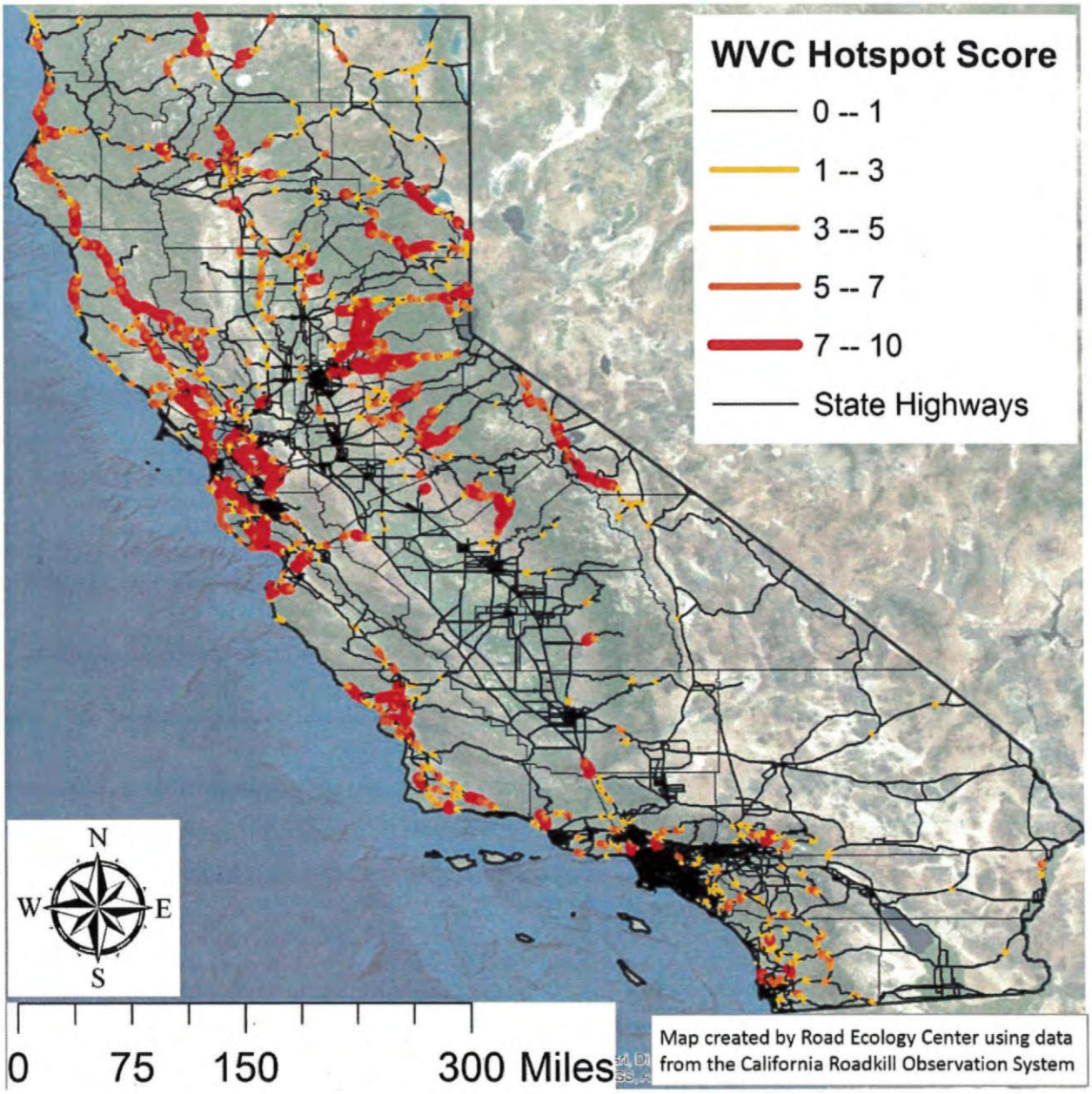


Figure 4. Statistically-significant, high-density WVC hotspots for 2015 to 2017. Hotspot score is a value that combines the total density of WVC incidents (#/mile) and the statistical significance of clusters of incidents. You can see these data here: https://roadecoloRy.ucdavis.edu/hotspots.

Real-Time, Automated Web-Map of WVC

To better inform the public and transportation agencies about highway segments with greater risk of WVC, we developed an easy-to-use, online system that provides two important sources of information: 1) mapped hotspots using legacy data (2015 to end of 2017); and 2) locations of recent (<1 week & <24 hours) locations of conflict with mule deer and other large mammals (Figure 5). You can find the website here: https://roadecology.ucdavis.edu/hotspots.

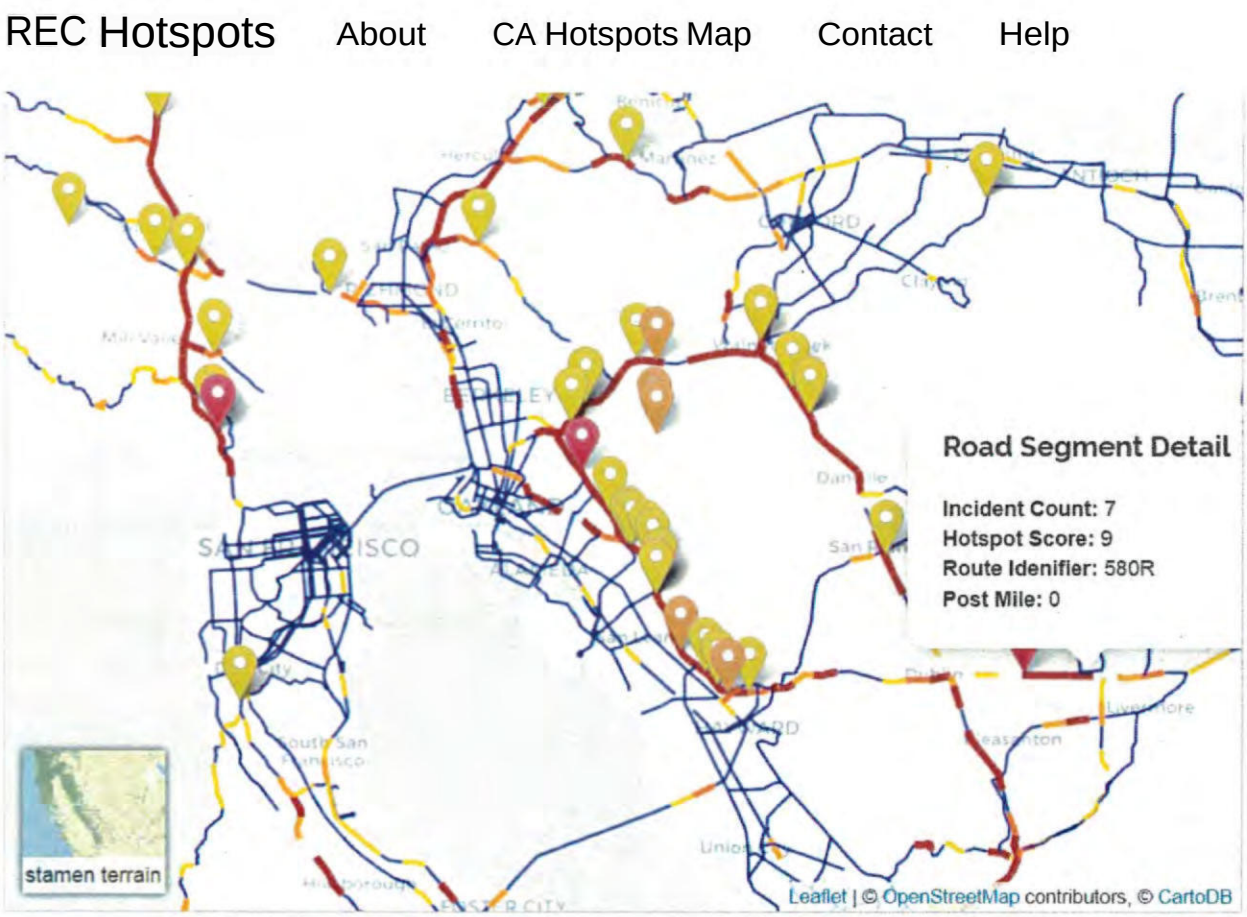


Figure 5. Zoomed in view of central San Francisco Bay Area showing incident densities and recent WVC incidents. The information box appears when the user clicks on a highway segment. https://roadecology.ucdavis.ed/hotspots.

We also developed the web-system so that it could be a continuous source of information for driver-assist, autonomous-vehicle, and app-based programs. For example, this information could be continuously fed into an app to inform drivers of locations of recent and long-term conflict, to inform their driving practice. It could also be used by driver-assist and autonomous vehicle systems to prioritize driver-warning and changes in sensitivity to the potential presence of large animals in the roadway.

Consequences of Collisions to Drivers and Society

Records analyzed show some individual drivers involved in collisions with animals, or who drive by injured animals and report them, experience emotional trauma and if the animal is larger, also face damage to their vehicle and injury (or even death) to themselves. Drivers may either collide with the animal, or swerve to avoid the animal and become involved in a collision with another vehicle or object (Table 1). We estimated the total cost of all WVC incidents to society, using summaries of types of accident (e.g., property damage only, major injury), the loss of wildlife,

and coefficients for each of these types of loss. Equivalent costs for accident types were obtained from the US Department of Transportation (USDOT, 2013) and a related project in South Dakota (Cramer et al., 2016). We only counted 1 fatality in data from CHP, but Caltrans reported 12 fatalities from collisions with wildlife for 2017, using data from CHP (http://www.dot.ca.gov/paffairs/pr/2018/prs/18pr072.html), so we used this number.

The rates of property damage, injury and death reported here are probably underestimates and may be superseded by more detailed information from other sources. For example, State Farm Insurance Co. estimates that there were >23,000 claims/year for collisions with deer in 2015- 2016 (https://newsroom.statefarm.com/download/234883/allstates2015-16deerstats-finalpdf.pdf), whereas our calculations are based on >6,600 reported collisions during this time period. If these additional 16,000 collisions resulted in the same average property-damage-only cost as used below (USDOT, 2013), there would be an additional >$277 million cost to society (16,000 times $17,343/crash), resulting in a total estimated cost from WVC of ~$584 million/year.

From 2016 to 2017, we found an increase of ~11% in cost to society from WVC, which was 20% higher than the year before. This does not reflect a change in how the calculation was conducted, but instead an increase in the number of fatal collisions.

Table 1. Impact to drivers and estimated cost to society of reported collisions with animals on California highways and certain major roads. Equivalent costs for accident types were obtained from the US Department of Transportation (2013).

Type of Accident	Coefficient (cost as $/event)	Number (2017)	Cost (2017)
Lost animal value (all animals)*			$37,377,000
Collision/Swerve (property damage)	$17,343	6,411	$111,185,973
Injury (minor)	$105,228	224	$23,665,146
Injury (major)	$506,217	44	$22,327,207
Fatality	$9,395,247	12	$112,742,964
Total			**$307,298,290**

* This value includes both reported and estimated un-reported carcasses. Others have reported under-reporting rates for carcasses from collisions of 5-10 fold (e.g., Olson et al., 2014).

Consequences of Collisions to Large Mammals, Animal Populations & Individual Animals

The majority of reported traffic incidents involving an animal (Figure 2) were with Mule deer *(Odocoileus hemionus,* 88%, Table 2), though at least 5 other mammals were also reported. In addition, these are just species and number of animals that were included in a CHP incident report. Others have reported under-reporting rates of collisions with ungulates (e.g., deer) of 5

to 10 fold (Donaldson and Lafon, 2008; Olson et al., 2014). This suggests that as many as 25,000 to 50,000 mule deer were killed during collisions in 2015 and an unknown number of other species. This is supported by the State Farm Insurance Co estimate of >23,000 claims/year for collisions with deer in California (https://newsroom.statefarm.com/download/234883/allstates2015-16deerstats-finalpdf.pdf), where collisions are likely to occur more often than claims.

One important observation was that almost twice as many black bears were reported involved in accidents in 2017 (170 animals) than in 2016 (89 animals), or 2015 (83 animals). In addition, there were more collisions with mountain lions in 2017 (64 animals) than in 2016 (44 animals), or 2015 (38 animals). It's not obvious why this occurred, but it is a disturbing trend for both wildlife and drivers

Table 2. The types and number of each type of wildlife involved in traffic incidents reported to CHP in 2016.

Wildlife type	Number	% of Total
Mule deer	5,862	88%
Coyote	353	5%
Black bear	165	2%
Wild Pig	145	<1%
Mountain lion	64	<1%
Elk	40	<1%

For people who have collided with an animal, some will have observed that the animal does not always die immediately. We found that 23% (n=l,495) of animals involved in incidents were reported as injured by responding law enforcement (Table 3). There were an additional 32% (n=2,119) with an unknown fate after being involved in a traffic incident. The rate of "unknown fate" for animals involved in a collision was much greater for elk, black bear and wild pig than mule deer, with the majority of these species having an unknown fate after collision. Only 149 animals were reported as dispatched by responding law enforcement officers, meaning that the remaining injured and some portion of the "unknown fate" animals stayed injured following the collision. This may still be an under-estimate of the total as there has been shown to be chronic under-reporting of collisions with ungulates, such as deer, in the US (Donaldson and Lafon, 2008; Olson et al., 2014).

Table 3. Animal outcomes following collisions with vehicles in 2017.

Animal Outcome	#	%
Unknown fate	2,119	32%
Alive / No Injury	597	9%
Injury	1,495	23%
Fatality, result of collision	2,841	43%
Fatality, result of dispatch	149	2%
Total	6,604	

In last year's report, we suggested that injuring animals in this manner could be considered cruelty. Although this may still be true, it makes sense to consider what solutions are available to reduce the unnecessary suffering of animals injured during collisions. A possible solution to this problem would be for the state to create a hotline where drivers can report an injured animal for potential rehabilitation, or in extreme cases, dispatch by CHP. Other countries (e.g., Germany, Sweden) have systems like this in place that could readily be adopted.

Regional/Local Focus

The need for projects that reduce the risk to driver safety and lives, property damage, and impacts to wildlife is critical. Building these projects will require a combination of Caltrans, county, regional, and legislative action and funding. This risk is greatest when there are more drivers driving fast through or near wildlife habitat, such as the San Francisco peninsula, the Sierra Nevada foothills and portions of Southern California (see following pages). The map below (Figure 6) shows the location of planned, state-funded projects in California, which are potential locations for wildlife-vehicle collision mitigation. Unfortunately, there is not very good overlap between WVC hotspots and planned projects, including those planned under the Senate Bill 1 (SB1) fuel-tax funding source. This may not be surprising as neither the California Transportation Plan, nor SB1 mention widespread, adequate mitigation for this risk to driver safety and wildlife well-being. However, it is a problem that can be solved by spending SB 1 and other state funds on wildlife-crossing projects. There is an immediate and urgent need for leadership on this issue in California and widespread construction of wildlife crossings solutions to reduce harm to drivers and wildlife. We suggest an expenditure rate of "1% for wildlife", which equates to ~$500 million from transportation funds per year, coincidentally similar to the estimated cost per year of WVC.

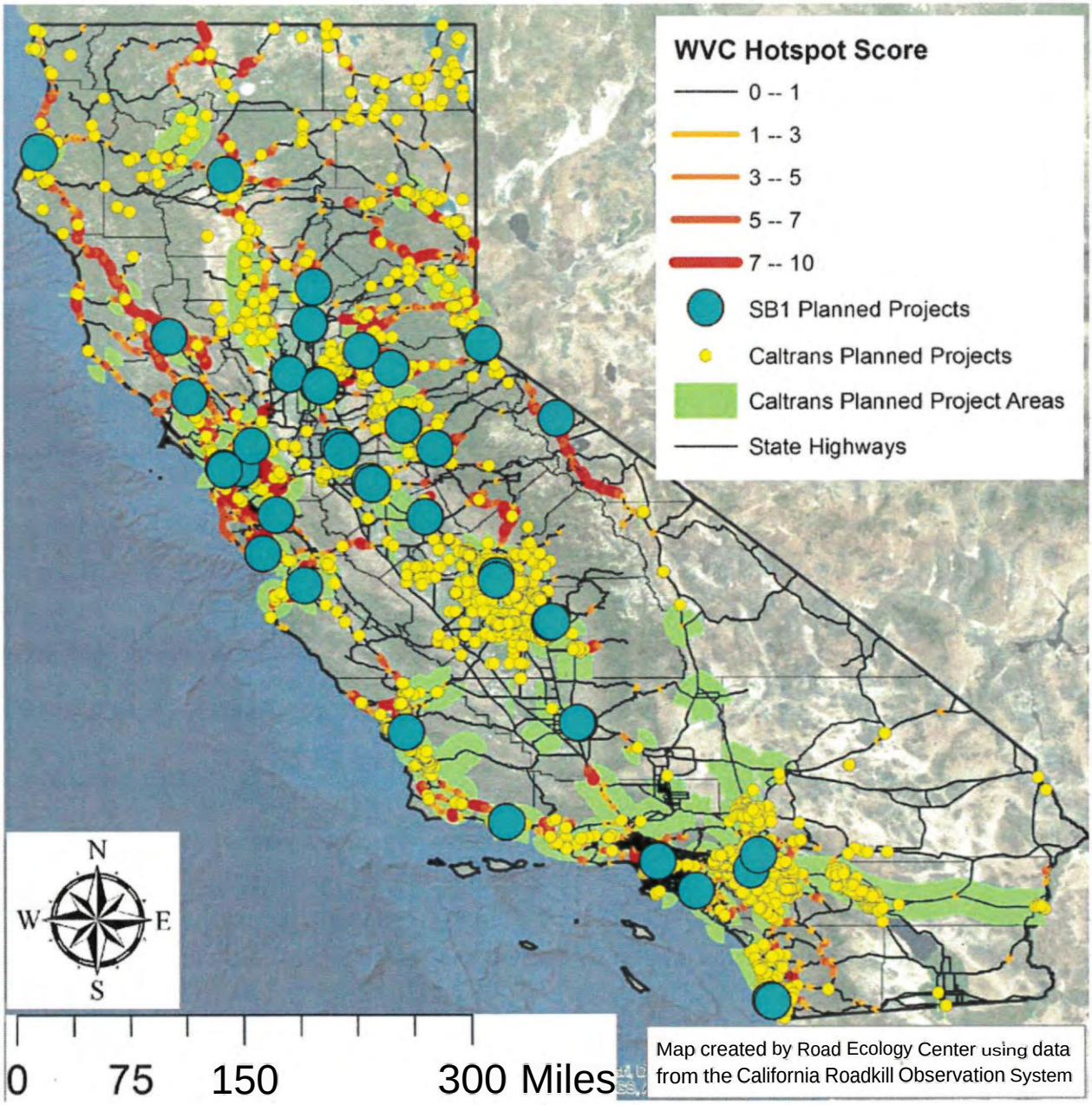


Figure 6. Locations of WVC hotspots and planned projects under the State Transportation Improvement Program (STIP) and Senate Bill 1, fuel-tax funding.

San Francisco Bay Area, Regional Highway Hotspots

This map shows the hotspots of WVC incidents on select highways in the San Francisco Bay region (Figure 7). There are segments of highways that have high enough rates of WVC that if safety projects, such as fencing and wildlife crossings, were undertaken, they would pay for themselves through reduced WVC. This is especially true for 1-280, the fencing of which would pay for itself in less than 1 year due to reduced WVC. Many major WVC hotspot areas have no planned highway projects, but projects should be planned to reduce risk and harm.

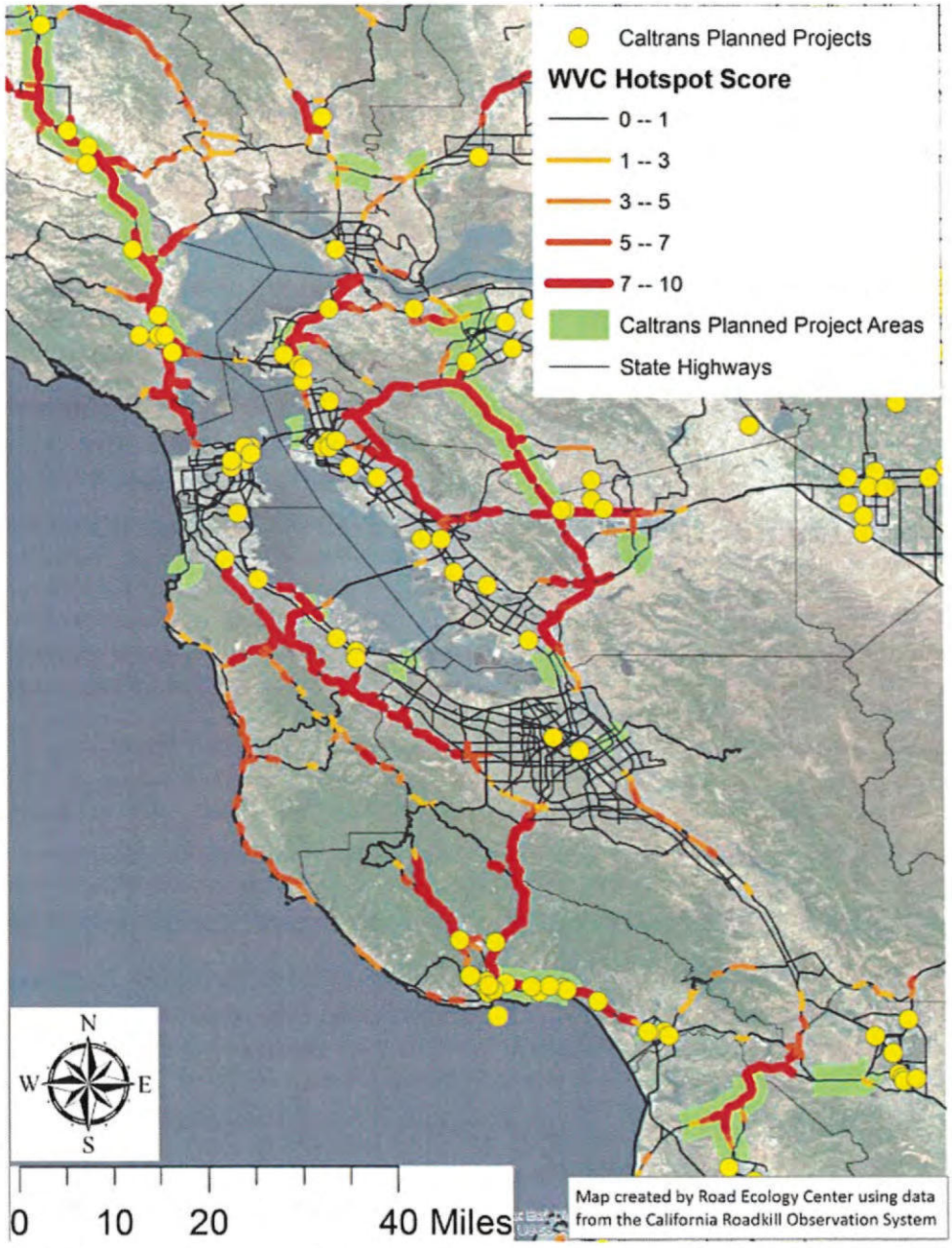


Figure 7. Overlap of WVC hotspot areas with state-planned/funded highway projects in the San Francisco Bay Area.

Southern California, Regional Highway Hotspots

This map shows the clustering of WVC incidents on select highways in the northern Los Angeles basin and mountains (Figure 8). There are segments of highways that have high enough rates of WVC that mean if safety projects, such as fencing and wildlife crossings, were undertaken, they would pay for themselves through reduced WVC. There are several planned state-funded projects that could be used to build wildlife-crossing mitigation. There are also major hotspot areas with no planned highway projects, for which projects should be planned.

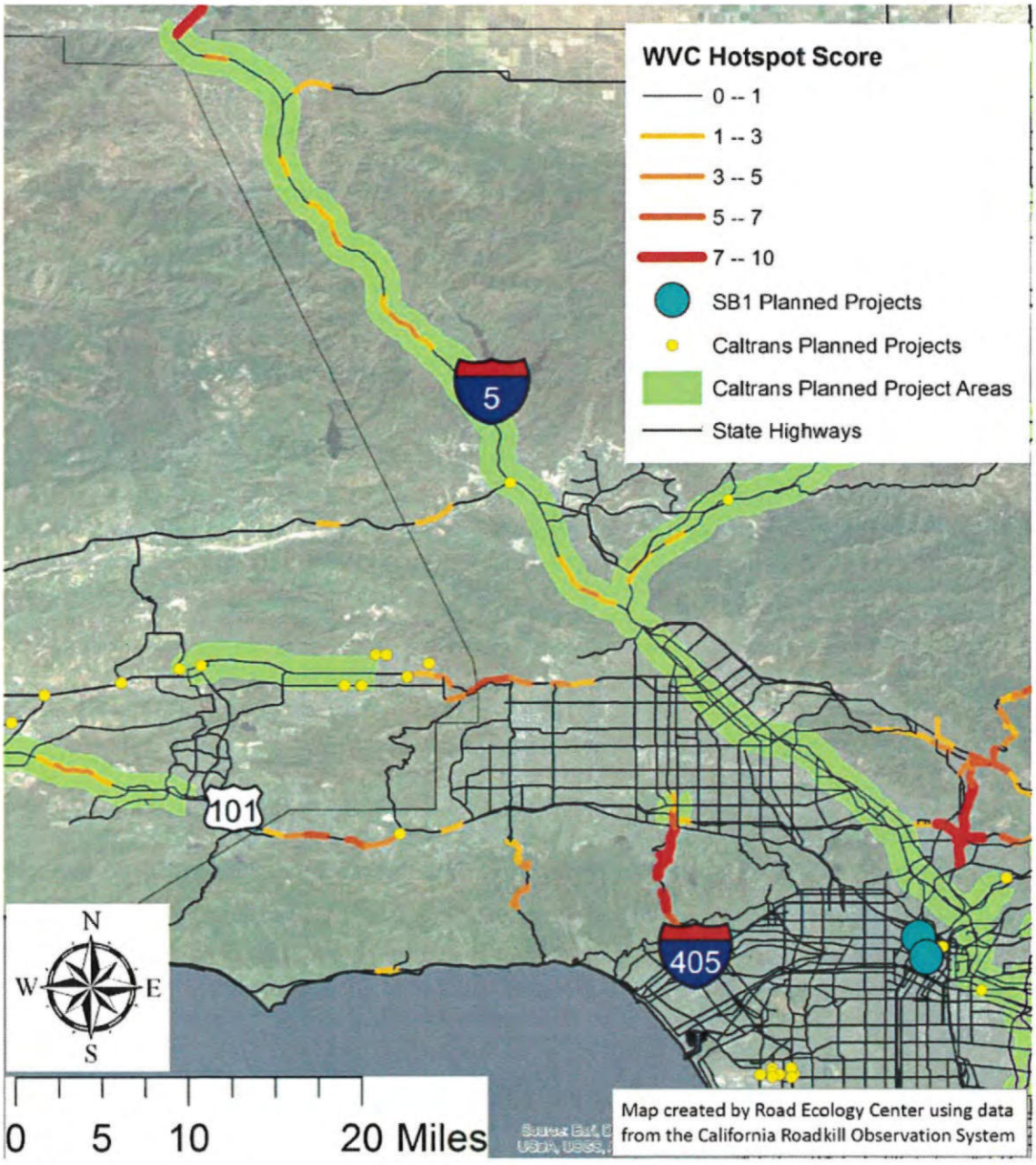


Figure 8. Overlap of WVC hotspot areas with state-planned/funded highway projects in the Southern California mountains north/west of Los Angeles.

Central California, Regional Highway Hotspots

This map shows the clustering of WVC traffic incidents on select highways in central-coastal California (Figure 9). There are segments of highways that have high enough rates of WVC that if safety projects, such as fencing and wildlife crossings, were undertaken, they would pay for themselves through reduced WVC.

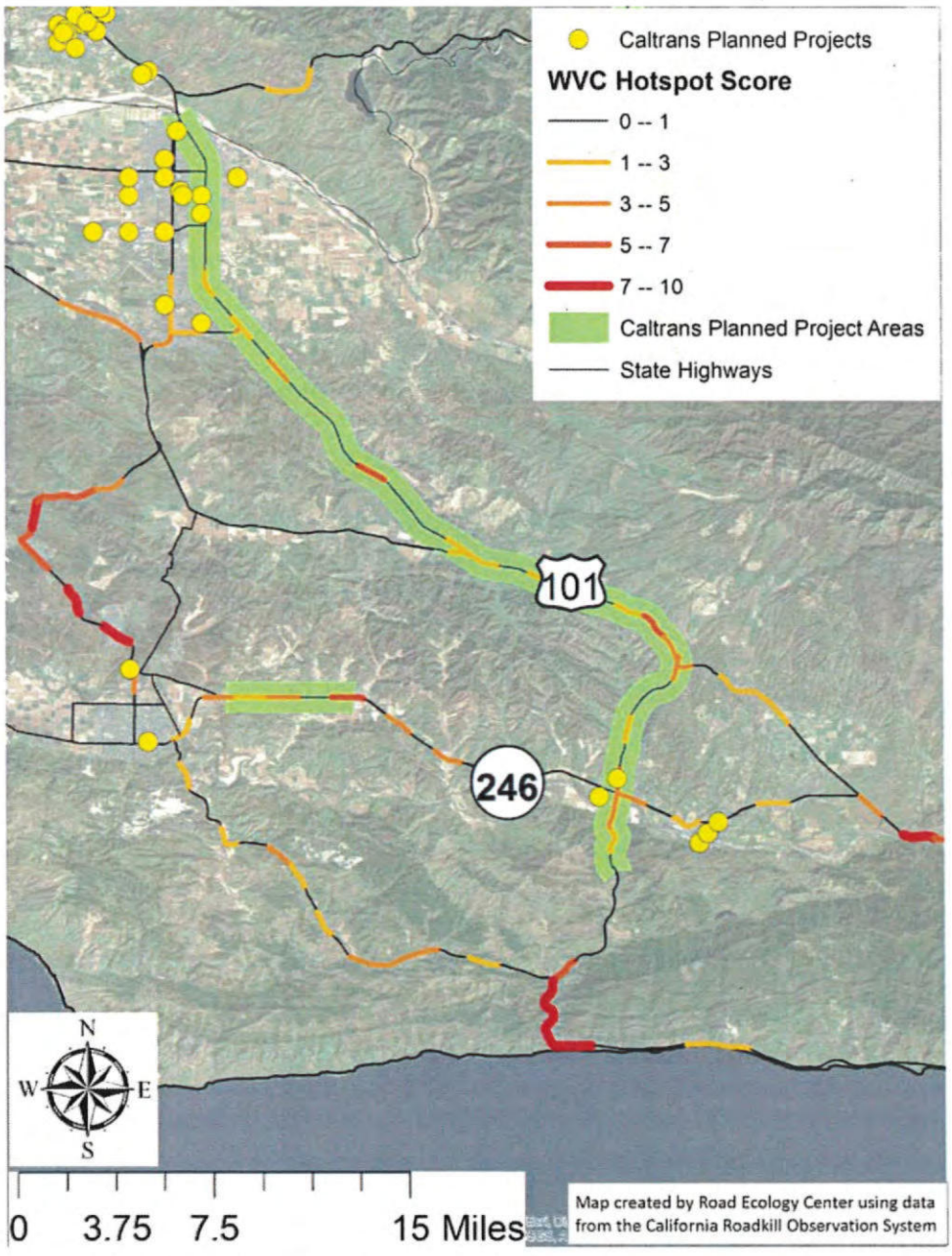


Figure 9. Overlap of WVC hotspot areas with state-planned/funded highway projects in the Central California coast near Lompoc.

Sierra Nevada Foothills, Regional Highway Hotspots

This map shows the clustering of WVC incidents on select highways in the Sierra Nevada foothills (Figure 10). There are segments of highways that have high enough rates of WVC that mean if safety projects, such as fencing and wildlife crossings, were undertaken, they would pay for themselves through reduced WVC. There are several planned SBI-funded projects that could be used to build wildlife-crossing mitigation. There are also major hotspot areas with no planned highway projects, for which projects should be planned.

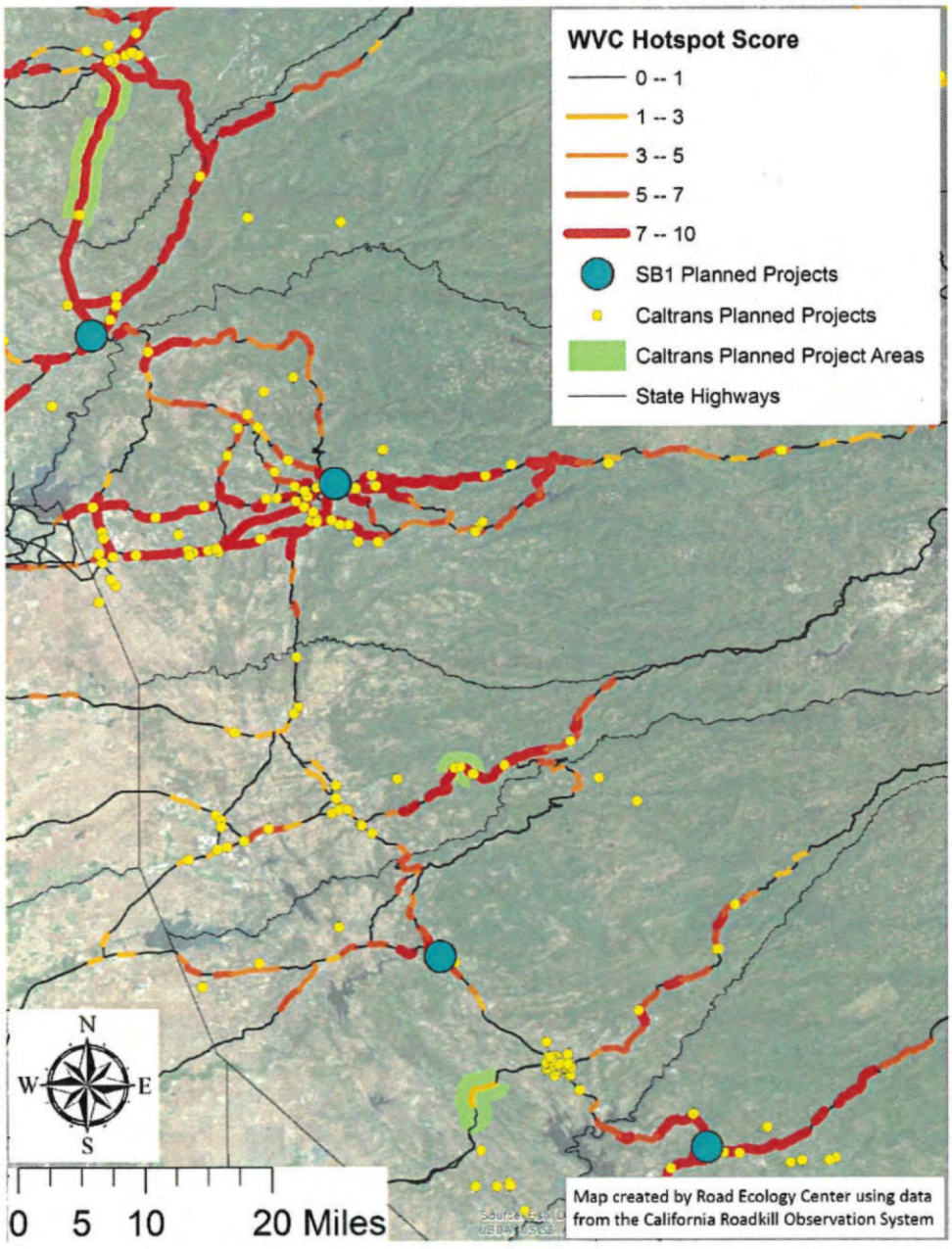


Figure 10. Overlap of WVC hotspot areas with state-planned/funded highway projects in the Sierra Nevada foothills east of Sacramento.

Citations

Cramer, P., J. Kintsch, K. Gunson, F. Shilling, M. Kenner, and C. Chapman. 2016. Reducing Wildlife-Vehicle Collisions in South Dakota. Report to the South Dakota Department of Transportation, SD2014-03-F.

Donaldson, B. and N. Lafon. 2008. Testing an integrated PDA-GPS system to collect standardized animal carcass removal data. Virginia Transportation Research Council. URL: http://www.virginiadot.org/vtrc/main/online_reports/pdf/08-crl0.pdf

Donaldson, B. M., YJ. Kweon, and L.N. Lloyd. An Evaluation of Roadside Activity and Behavior of Deer and Black Bear to Determine Mitigation Strategies for Animal-Vehicle Collisions. Publication VTRC 16-R4. Virginia Transportation Research Council, Charlottesville, 2015.

Donaldson, B. M. Improving Animal-Vehicle Collision Data for the Strategic Application of Mitigation. Publication VTRC 18-R16. Virginia Transportation Research Council, Charlottesville, 2017.

Olson, D. D., J. A. Bissonette, P. C. Cramer, A. D. Green, S. T. Davis, P. J. Jackson, and D. C. Coster. 2014a. Monitoring wildlife-vehicle collisions in the information age: how smartphones can improve data collection. *PLoS ONE,* 9(6): e98613. DOI:10.1371/journaLpone.0098613

Shilling, F.M. and Waetjen, D.P. 2015. Wildlife-vehicle collision observation collection and hotspot identification at large scales. *Nature Conservation,* 11: 41-60. doi: 10.3897/natureconservation.11.4438

Waetjen, D.P. and F.M. Shilling 2017. Large extent roadkill and wildlife observation systems as sources of reliable data. *Frontiers in Ecology and Evolution, doi: 10.3389/fevo.2017.00089*

US Department of Transportation. 2013. Guidance on treatment of the economic value of a statistical life in U.S. Department of Transportation analyses. URL: https://www.transportation.gov/sites/dot.dev/files/docs/VSL%20Guidance%202013.pdf

Appendix 1: (More) Detailed Methods

Data Sources

State highway network (SHN) and post-mile (PM) spatial datasets were obtained from Caltrans (http://www.dot.ca.gOv/hq/tsip/gis/datalibrary/index.php#Highwav). All traffic incident data from California Highway Patrol (CHP) resources, beginning in 2/2017, were collected by the UC Davis Road Ecology Center's "California Highways Incident Processing System" (CHIPS) and ingested into a database. This database was then queried for incidents involving animals to create a dataset of Animal-Vehicle Conflict (AVC). The CHIPS AVC data includes collisions between vehicles and wildlife/domestic animals, carcasses found on highways, traffic hazards caused by animals, and other types of traffic incidents involving animals.

Each CHIPS data point contains several fields relating to the incident it represents. These fields include latitude, longitude, street or intersection name, animal species, and any details the CHP officer noted regarding the incident. Many points have multiple entries in the details field, meaning CHP documented updates to the incident as it progressed. These descriptions provide a thorough narrative of the incident, as well as details on the time that events occurred through the eyes of a CHP officer. Other fields in the AVC dataset are manually entered by the Road Ecology Center if they are included in the descriptions. Attributes include data like vehicle damage, driver and animal outcomes, and type of incident (e.g., swerve vs. collision).

CHIPS data represents incidents on California's state, interstate, and federal highways. CHP does respond and document incidents on some unincorporated roads near highways, but incidents more than 50 meters from a highway were excluded from this study.

It is important to note that CHIPS AVC data are a subset of reported incidents on California highways. Unreported incidents and incidents on roads falling outside of the jurisdictions of CHP are not included. CHP has jurisdiction on all federal, state, and interstate highways and public roads in certain unincorporated areas. Therefore, CHIPS incidents are not a record of all AVC in California, but events which induce a documented report within CHP jurisdiction.

Of the AVC incidents, ~90% of the incidents involved mule deer. It can be inferred that animals large enough to cause damage to a vehicle are more likely to be reported to CHP. A minimal number of incidents involve small animals, such as pigeons, geese, and dogs. These are included in the analysis dataset, but do not represent the entirety of incidents with those smaller animals. Thus, this analysis does not represent AVC with smaller species, since those incidents are unlikely to be reported.

Assuming CHP consistently and accurately documents incidents across the state highway network, CHIPS data provides a spatially unbiased dataset of AVC involving large animals on California highways.

Geoprocessing

The datasets from the previous section were processed using the programming language R and ESRI ArcMap 10.6. The following geoprocessing steps were performed to create the automated hotspot analysis for AVC.

Network Segmentation

The basis for the AVC network analysis is the highway network, In order to create a uniform unit for analysis, one-mile segments were created for highway networks. The Caltrans SHN was used for the AVC analysis of California. The highway lines were split at each one-mile PM. This created a fairly uniform set of segments, split at well-known locations.

Assigning Incidents to Segments

A custom R script was written to assign AVC incident points to spatially corresponding road segments. The R script uses the snapPointsToLines function in the maptools library. Points >50 meters from any segment were filtered out. This approach did not attribute incidents to incorrect road segments. The number of AVC incidents for each segment was summed in an attribute field to the segment, which is the metric of primary importance in the WVC analysis. A maximum distance of 50 meters was chosen when snapping incident points to road segments. Since CHP often records data on road shoulders, and the highway network is often on the centerline of roads, or between separated highway lanes, and GPS receivers have an accuracy radius, point locations are usually a short distance away from network lines. However, incorporating points further than necessary would have included WVC points on roads not in the analysis, inaccurately inflating density distribution.

Clustering Statistics – Hotspot Score

To provide a different view of the spatial distribution of AVC along the network, the GetisOOrd Gi* statistic was used to statistically analyze clusters and to contribute to a hotspot score for each one-mile road segment. An R script ran a local Getis-Ord calculation for each segment on the network, analyzing the number of incidents snapped to each segment. The default neighbor radius is one mile (1609 meters), and a binary weighted matrix including the value of the segment The script adds a Gi* z-score value to each segment, denoting if the segment is in a relative "hotspot" or "coldspot".

The Gi* statistic is well-suited to identify hot and cold locations in density distribution, the resulting z-score is not clearly understood by all audiences. Moreover, some additional nuances of WVC distribution should be incorporated into an easily shared "hotspot score".

Using the Gi* value, a "hotspot score" was created to more effectively communicate the results. First, segments with a) zero incident density or b) a negative Gi* value are assigned a hotspot score of zero. This avoids over-smoothing the score, to reveal highway segments with no incidents in a region of high incidents. Then, a percentile of each Gi* value within the distribution of remaining non-zero segments is calculated. Finally, an integer value from 1-10 is given to each segment by rounding up the percentiles. The hotspot score is a means of synthesizing incident density and spatial clustering, but presenting it in a way that is easily understood by all audiences. The process can be implemented on any network, and will categorize network segments into 10 equally sized categories, where each segment with a score greater than zero has incident densities and positive Gi* values.

CALIFORNIA ACTION PLAN

For

Implementation of Department of the Interior Secretarial Order 3362: "Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors"

Introduction - Secretarial Order 3362 (SO 3362) directs appropriate agencies within the Department of the Interior [U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), and Bureau of Land Management (BLM)] to work in close partnership with the State of California to identify, enhance, and improve the quality of big-game winter range habitats and migration corridors on appropriate DOI managed lands in a way that recognizes state authority for conserving and managing big-game species and respects private property rights. Through research and land management actions, wildlife such as mule deer *{Odocoileus hemionus* hereafter deer), pronghorn antelope *{Antilocapra americana',* hereafter pronghorn), Rocky Mountain elk *{Cervus canadensis),* Roosevelt elk *(C. c. roosevelti),* and Tule elk (C. *c. nannodes',* collectively hereafter elk) and other wildlife and their habitats may benefit.

Conditions in the broader landscape may influence the function of migration corridors and sustainability of big game populations. Such conditions may include habitat fragmentation, land use patterns, resource management, or urbanization. The United States Department of Agriculture (USDA), through the USDA Forest Service (USFS) and USDA Natural Resource Conservation Service, will collaborate with DOI, the states, and other natural resource managers across the broader landscape when developing an all-lands approach to research, planning, and management, for ecological resources, to include migration corridors in a manner that promotes the welfare and populations of elk, deer, and pronghorn, as well as the ecological integrity of terrestrial ecosystems in the plan area.

California has about 99.7 million acres of total land area, and approximately 22.9 million acres (23.0%) are managed by three DOI agencies: BLM (15.0 million acres; 15.0%), NPS (7.6 million acres; 7.6%), and USFWS (0.3 million acres; 0.3%; Fig. 1). An additional 20,8 million acres (20.8%) are managed by the USFS.

To achieve the objectives of SO 3362, the Department of Interior has asked states to identify 3-5 priority migration corridors or winter range habitats for big game species in their respective state. Where information on specific migration corridors or winter range habitat is lacking, the DOI has requested states to identify their top 2-3 research priorities to fill these data or knowledge gaps. The following summary outlines California's justification for fulfilling these requests.

The following migration corridors the California Department of Fish and Wildlife (CDFW) has identified reflect a careful consideration of population stressors, habitat quality and geography (Fig. 2).

Corridor/Winter Range – Mule Deer

Mule deer ***(Odocoileus hemionus)*** are common throughout the State of California. East of the Sierra Nevada Crest they are managed within premium deer hunt zones. Deer habitat in California includes a mix of densely forested summer range and more open shrub communities on winter range. These deer are mostly migratory, moving into both Oregon and Nevada, and as such are managed cooperatively with those states. Primary threats on summer range include development, fire impacts, lack of early serai habitat, and high human population and disturbance. On winter range, development, fire and conversion of habitats to invasive weed species and senescence of high quality forage are important issues for deer. Many migration corridors traverse multiple highway systems, which creates cumulative impacts in the form of direct mortality or conditions that tax deer energetically as they attempt daily or seasonal movements between ranges.

Conservation of deer habitat and management of herds will be challenging for deer managers with the CDFW. Land use practices often times conflicts with wildlife habitat needs. The USFS is the primary federal landowner (>20%) in California (Fig. 1) and often manages forests to provide a high canopy cover of even-aged stands. This not only reduces early serai habitat opportunity but provides widespread fuel for intense wild fire, which affects deer habitat across their range.

Many research projects have, or continue to monitor, deer movements but there are gaps in information. A comprehensive statewide migration assessment plan is currently being developed for deer in California. This project will collect high-resolution movement data suitable for robust spatial analyses to identify important corridors and stopover locations and provide much needed information to inform wildlife managers.

Mule Deer, Mono Ecoregion, Deserts Province, X9a Deer Hunt Zone

- Rationale for prioritization
  - Between 2002-2015,1,845 deer fatalities were recorded on California Department of Transportation (Caltrans) facilities in District 9, which includes Mono County with 397 deer collisions occurring on the US Highway 395 corridor between State Route 203 and the Crowley Lake area.
  - A preliminary report by the University of California, Davis, identified Highway 395 on the east side of the Sierra Nevada as an area with statistically significant hotspots for vehicle-wildlife collisions (Shilling et al. 2016). In addition to deer, this area contains bear, mountain lion, numerous meso-carnivore species, and a variety of other wildlife.

- An 8-foot high, chain-link deer fence is planned for installation around the perimeter of the Mammoth-Yosemite Airport, which is located east of Highway 395 between mile markers 22.74 and 20.36. The fence will include a 1.7 mile long segment that abuts the Caltrans right-of-way on the east side of the highway. No adjacent fencing will be installed on the west side of the highway and no crossing structures are proposed to be constructed as part of the project. Because of the absence of suitable crossing structures, the fence will likely trap deer within the ROW and increase deer-vehicle collisions.
- This area is of high importance to deer as the habitats on both sides (east and west) of Highway 395 is utilized for summer range, migration, migration transition (holding areas for spring and fall migrations) and winter range during droughts.

> Spatial location
- Located in Mono County, deer winter, transition and summer ranges are along Highway 395 from State Route 203 to Crowley Lake.

> Habitat types (Fig. 3)
- Habitat varies depending upon altitude and aspect and includes shrub-steppe and shrub communities, open forest communities, and alpine meadows.

> Important stopover areas within the corridor
- Limited anecdotal information available. This area provides important holdover habitat (Sherwin Holding Area) that is intensely used by deer for 6-10 weeks in the spring and for several months in the fall.

> Landownership (Fig. 4)
- The USFS (Inyo National Forest) owns much of the land along the north section of the corridor. The Bureau of Land Management and the Department of Water and Power, City of Los Angeles own sections along the southern corridor.

> Land uses
- Heavy recreation use and livestock grazing.

> Risks/Thieats
- Immediate Threats
  - High deer-vehicle collision rates along highways.
    - State Action: Identification of important seasonal crossing areas.
    - State and Federal Action: Funding and other support for installation of passes and other crossing structures in areas with the greatest need to reduce collisions and provide safe passage to deer and other wildlife during migration.
- Long-term Threats
  - Increasing development and fragmentation of available winter and migratory habitat.
    - State Action: Identify site-specific crossing locations within the corridor.
  - Expectation of continued high-intensity catastrophic wildfires throughout the zone due to high fuel loads from historic fire suppression efforts and persistent drought conditions in recent years.

- Federal Action: Forest thinning, noxious weed control, and planting of native shrubs with prioritization for high-use deer areas on federal lands.

> Current efforts
  - Improving movement corridors for migratory deer in this area is of such importance that a multi-agency task force consisting of CDFW, Mono County, Mammoth Lakes, Caltrans, Eastern Sierra Land Trust, and BLM are developing a strategy to address the ongoing problem and seeking funds for implementation.
  - Caltrans has prepared a feasibility study that evaluated methods and concepts to reduce wildlife collisions (Caltrans 2016).

Mule Deer, Sierra Nevada Ecoregion, Central Valley and Sierra Nevada Province, X6a, X6b, and X7a Deer Hunt Zones

> Rationale for prioritization
  - This area contains migratory deer from two herds and the premium hunt zones X6a, X6b and X7a (an estimated 9,400 animals) which represents a big portion of the states deer and a highly threatened area. Deer have extreme financial and ecological value in this area. In addition to deer, this area contains pronghorn, an expanding population of elk, and occasionally bighorn sheep and gray wolf.

> Spatial location
  - Between Reno, NV and Susanville, CA on the east side of the Sierra Nevada Range along Highway 395.

> Habitat types (Fig, 5)
  - Habitat varies and includes sagebrush steppe and shrub communities, dense forest communities, and agriculture lands.

> Important stopover areas within the corridor
  - Limited information available, these tend to be quick and short migrations but stopovers exist. In the Loyaton-Truckee Herd these include the Antelope Valley Wildlife Area, Dog Valley, Bear Valley, and the Prosser/Boca Reservoir area.

> Landownership (Fig. 6)
  - Most of the area is owned by public agencies, with the Tahoe and Lassen National Forests, BLM, and CDFW's Hallelujah Junction and Doyle Wildlife Areas (HJWA) being the major public land holdings. Private timber companies also own large portions of forested areas within this area. Most other lands held in private ownership are interspersed along the highway including developments at Cold Springs, Doyle, Janesville and others.

> Land uses
  - Livestock grazing, human development, recreation, and timber harvest are the predominant uses.

> Risks/Threats
  - Immediate Threats
    - Conversion of habitat to invasive weeds in wintering areas due to disturbance from largescale and high-intensity wildfires, conifer

encroachment on open shrub communities} senescence of nutritional forage.
    - Growing use and distribution of motorized and non-motorized off-road vehicles and increasing disturbance on winter ranges.
    - High deer-vehicle collision rates along certain sections of the highway.
    - Crossings exist at HJWA and on Highway 89 but additional structures and fence are needed. Connectivity must be created and maintained across the highway to reduce collisions and other cumulative impacts from barriers during daily and seasonal movements.
    - Persistent drought conditions resulting in reduced overall nutritional carrying capacity of the landscape and new indications of shifts in migration strategy, which could condense deer on summer range if they don't migrate.
  - Long-term Threats
    - Increasing development and fragmentation of available winter and migratory habitat in the area. Nevada does not have CEQA/CESA processes to limit or mitigate development. As Reno expands, winter range is being heavily developed. Critical ranges and corridors must be identified and protected.
    - Expectation of continued high-intensity catastrophic wildfires throughout the area due to high fuel loads from historic fire suppression efforts 'and persistent drought conditions in recent years.
    - Mid-elevation forests used by deer during the spring and fall are mostly comprised of closed-canopy, over-stocked stands of mixed conifer species with little understory vegetation. Bums and cuts on privately owned timberlands or FS lands are often treated with herbicide and replanted with single age stands, eliminating early serai conditions.
- Current efforts
  - CDFW has been working to improve communication with the Caltrans to increase planning and mitigation of road projects in impacted areas. The Highway 89 Stewardship Team (H89ST) constructed three underpasses with fence and jumpouts on Highway 89, a stretch that deer in the area cross. CDFW has also collaborated with the Nevada Department of Wildlife to address interstate deer issues, connectivity between states and end-run issues at deer fences along the border.
  - Post-fire activities have included seeding for bitterbrush.
  - Jumper removal projects on CDFW land.
  - A number of collars have been deployed for use in a population estimate project, and by the H89ST to monitor and effectively place crossings on the highway. More detailed analysis with a focus on migration and stopovers is needed.
  - BLM have performed post-fire restoration activities following the Long Valley Fire in 2017. They also plan to replace -3,600' of 8' tall fencing in the Fort Sage Off-highway Vehicle Area with wildlife friendly fencing to facilitate better access to surrounding BLM lands and habitats. Additional post-fire rehabilitation plans

include drill, broadcast, and hand-seeding of ~5,353 acres of burned shrubland communities. Noxious week control will occur through implementation of the Eagle Lake Prevention Schedule.

Mule Deer, Sierra Nevada Ecoregion, Central Valley and Sierra Nevada Province, X7b Deer Hunt Zone

- Rationale for prioritization
  - This area contains migratory deer from the Loyalton-Truckee Deer Herd in the premium hunt zone X7b (an estimated 1,500 animals). Summer range is very limited and highly developed leaving small pockets of intact habitat. Migration is short but is constricted by the Truckee River, the railroad tracks and Interstate 80 through the Truckee River Canyon. Deer have extreme financial and ecological value in this area. In addition to deer, this area contains bear, mountain lion, occasional gray wolf and a variety of other wildlife.
- Spatial location
  - This area is a smaller stretch along Interstate 80 from Donner Summit in CA to Verdi, NV.
- Habitat types (Fig. 7)
  - Habitat varies as you move west to east but includes coniferous forest with closed canopy, bitterbrush and shrub communities, riparian habitat, and pockets of aspen.
- Important stopover areas within the corridor
  - Stopovers are not prevalent in this short migration. Deer move quickly between summer and winter range but tend to stay on summer range later in the year until snow and temperature pushes them out, sometimes in December.
- Landownership (Fig. 8)
  - Much of this area is privately owned with the Tahoe National Forest and CDFW comprising the majority of the public land.
- Land uses
  - Livestock grazing, human development, and recreation are the predominant uses.
- Risks/Threats
  - Immediate Threats
    - Development has been somewhat limited with CEQA but does continue, especially around already impacted ski resorts, and the town of Truckee.
    - Fragmentation by development, the interstate, railroad, river, and recreation is prevalent throughout the area.
    - Direct vehicle mortality on the interstate and roads throughout developed areas along with high predator concentrations are additive mortalities to the deer herd.
  - Long-term Threats
    - Most of the deer in this zone are migratory and winter in the lower elevations on the Nevada side. Summer range habitat is limited, and weather conditions such as persistent drought has caused shifts in migration strategy, concentrating deer year-round on limited summer range. This could change the herd dynamics drastically.

- Conversion of habitat to inhospitable cheatgrass communities.
- Moving around barriers to reach deaired habitat is energetically taxing. Fecundity and fawn survival could be an issue if connectivity is not restored or maintained.
- Interstate 80 is one of several highways, but the most significant that bisects the Sierra Nevada mountain range. Major crossing features to connect habitat on either side are absent but needed and could open the corridor to movement by many species, including sensitive meso¬ carnivores.

> Current efforts
  - o Projects on CDFW lands have involved noxious weed control and natural regeneration after fire.
  - o Monitoring of deer crossing under the highway with cameras.
  - o CDFW has used GPS collars to update the Loyalton-Truckee Deer Herd Plan.
  - o USFS has performed revegetation and habitat restoration in key winter habitats for mule deer following wildfires across the area. Additionaly, ~500 ac. are treated annually to control invasive plants to reduce wildfire risk and risk of vegetation type conversion to annual invasive grasses. Treatments include mechanical, biological (insects), hand, and herbicide treatments. Key riparian and meadow areas are the focus of reseeding and replanting efforts (~100 ac.). The Humboldt-Toiyabe National Forest is a member of a wildlife working group that focuses on opportunities to improve habitat for mule deer and other wildlife within this important deer migration corridor.

Corridor/Winter Range – Elk

Roosevelt Elk, Northern California Coast Ecoregion, North Coast and Klamath Province, Northwestern Elk Hunt Zone

> Rationale for prioritization
  - a Along the north coast, populations of Roosevelt elk have expanded dramatically in the last 20 years. Del Norte and Humboldt counties in northwestern California have experienced growing conflict as a result of burgeoning Roosevelt elk herds and vehicle collisions along the Highway 101 corridor.
  - o As these Roosevelt elk populations continue to grow, access to suitable habitat can be limited by barriers such as Highway 101 and elk may tend to concentrate on private lands creating even more conflict and management issues by potentially impacting agricultural crops and property. CDFW continues to work with local governments, tribes, and landowners to expand hunter opportunities to help reduce conflict and manage the growing Roosevelt elk populations. Improving movement corridors may also help increase the accessibility of elk on public land and thereby reduce conflict.

- Elk respond predictably to increased hunting pressure and traffic density by becoming more mobile and expending more energy avoiding people and roads (Hurley and Sargeant 1991, Lyon and Canfield 1991). In addition, increased road density has been shown to increase the probability of mortality in cow elk, to decrease the ratio of bulls to cows, and to increase hunting harvest mortality when compared to relatively roadless areas (Leptich and Zager 1991, Unsworth et al. 1993, Leptichet al. 1995).
- A preliminary report by the University of California, Davis, identified U.S. 101, a major highway running north and south through Del Norte and Humboldt counties, as an area with significant hotspots for vehicle-wildlife collisions (Shilling et al. 2016). The North Coast (Caltrans District 1) was reported as having the third highest density for wildlife-vehicle conflict (Shilling et al. 2017).

> Spatial location
- North coast of California along the Highway 101 (Del Norte and Humboldt counties).

> Habitat types (Figs. 9 and 10)
- Habitat varies from forested timberlands to agricultural lands.
- Elevation in this area ranges from sea level to over 6,000 feet. Generally, most of Humboldt and Del Norte counties provides suitable habitat for elk including conifer and mixed conifer-hardwood forest, oak woodlands, montane and bottomland grasslands, and marshes.

> Important stopover areas within the corridor
- Elk that exist along the coast tend to utilize small home ranges and do not migrate seasonally. This has led to an area of high concentration of elk along Highway 101. Inland there, does appear to be seasonal changes in habitat utilization but this extent is much smaller than what is observed in other parts of the state-.

> Landownership (Figs. 11 and 12)
- Private ownerships inhabited by elk include timberlands, ranches, dairies, farms, and rural residential areas.
- Ownership is mixed between public, tribal and private holdings with some large blocks of USFS and private timber.
- Approximately 60% of this area is privately owned with most public land, administered by the USFS (Six River National Forest), BLM (Lacks Creek and King Range), and Redwoods National and State Parks property.

> Land uses
- The main land use in this area includes timber production and agricultural practices ranging from irrigated crop production to dairy and cattle production.

> Risks/Threats
- Immediate Threats
- Several herds of elk routinely cross Highway 101 and are utilizing area adjacent to roadways to an extent that causes serious safety concerns for motorists.

Table 1. Number of accidents related to animal collisions along two stretches of Highway 101 extending from Trinidad, CA to the Del Norte/Humboldt County line (mile marker 100.705 to 137.144) and from Mill Creek to the

Oregon/Califomia State line (mile marker 20.270 to 46,492). Information provided by the Department of Transportation from 1 January 2005 to 30 June 2015.

Mile Marker		Total Accidents	Fatalities	People Injured	Species	
Start	End				Deer	Other
20.270	46.492	66	1	8	52	13
100.705	137.144	82	0	22	59	20

Table 2. Average daily traffic, represented as the number of vehicles per day, from 1 January 2015 to 30 June 2015 along two stretches of Highway 101 extending from Trinidad, CA to the Del Norte/Humboldt County line (mile marker 100.705 to 137.144) and from Mill Creek to the Oregon/Califomia State line (mile marker 20.270 to 46.492).

Mile Marker		Average Daily Traffic
Start	End	
20.270	46.492	8,000
100.705	137.144	3,800

- Long-term Threats
  - As population numbers increase along this section of highway, an increase in collisions is anticipated.

> Current efforts

- Current research efforts on the North Coast are being accomplished through Federal financial assistance made available through the Pittman-Robertson Wildlife Restoration Act.
- The main objective of current research efforts focuses on providing information about elk population parameters for management and conservation planning. Knowledge about the relative abundance, distribution, and population trends is important in the assessment of past management plans and practices.
- 31 elk are currently collared in Humboldt and Del Norte counties. This collar data allows the collection of the following data: subherd identification, habitat use and resource selection, movement patterns and population connectivity, recruitment estimates, calf survival, causes of mortality, and mark-resight estimates of abundance. Several techniques for monitoring elk populations in northern California are also beginning to be examined. These include: road surveys, camera traps, and fecal DNA mark-recapture estimates. This research will lead to the development and implementation standardized monitoring protocols for estimating elk population parameters.

- BLM has completed ~200 acres of oak woodland and grassland restoration in Lacks Creek Management Area. They have also removed Douglas-fir and replanted with native grasses to improve forage for elk. Several prairie bums have also been deployed, and all of these BLM activities have been undertaken with contributions from Rocky Mountain Elk Foundation (RMEF), Mule Deer Foundation, and California Deer Association.

Tule Elk, Central Valley and Sierra Nevada Province and Bay Delta and Central Coast Province, San Luis Reservoir Elk Hunt Zone

- Rationale for prioritization
  - This area contains the San Luis Reservoir Tule Elk meta-population, which is estimated at 1,000 animals. Tule elk are still recovering from near extirpation and require large tracts of land to support healthy populations.
  - Information on movement corridors between habitat patches is needed to identify and model critical habitats, linkages, and barriers to movement, which hinder critical gene flow.
  - The information from this project will benefit current and future management and conservation practitioners by providing them with spatial and resource selection information which describe and delineate areas of important use including home ranges, calving areas, habitat use, barriers, and meta-population movement corridors.
- Spatial location
  - Located in Merced County, the elk subpopulations around San Luis Reservoir within the San Luis Reservoir Tule Elk Hunt Zone.
- Habitat types (Fig. 13)
  - Habitat varies depending upon elevation and aspect and includes non-native annual grasslands and oak woodlands.
- Important stopover areas within the corridor
  - Data collected from GPS collars that have been deployed since 2015 are currently being analyzed.
- Landownership (Fig. 14)
  - Ownership is distributed between CDFW property, California Department of Parks and Recreation, Bureau of Reclamation, and Private.
- Land uses
  - Land use in the area is comprised mainly of livestock grazing, agriculture, and recreation.
- Risks/Threats
  - Immediate Threats
    - Elk-vehicle collision rates along highways.
      - State Action: Identification of important seasonal crossing areas.
      - State and Federal Action: Funding and other support for installation of passes and other crossing structures in areas with the greatest need to reduce collisions and provide safe passage to elk during migration and daily movements.

        - High-speed Rail
            - State Action: Identification of important use areas including calving grounds, home ranges, and crossing areas.
            - State and Federal Action: Funding and other support for installation of passes and other crossing structures in areas with the greatest need to reduce collisions and provide safe passage to elk during migration and daily movements.
    - Long-term Threats
        - Increasing development and fragmentation of habitat.
            - State Action: Delineation of important movement corridors and stopover locations to support empirically-based decisions regarding prioritization of habitat conservation needs in those areas.
        - Expectation of continued conversion from native habitat to non-native invasive plant species.
            - State and Federal Action: Large-scale habitat restoration is needed to restore the habitat to support a healthy ecosystem. Prescribed bums and noxious weed control along with revegetation efforts are needed.
        - Low genetic diversity
            - State Action: Delineation, preservation, and creation of important movement corridors is needed to maintain and facilitate critical gene flow between sub-groups and meta-populations.

> Current efforts
    - CDFW has been working to improve communication with the Caltrans to increase planning and mitigation of road projects in impacted areas.
    - CDFW has been coordinating with California State Parks regarding habitat restoration projects on State Parks lands.
    - CDFW has been working with the Santa Clara Open Space Authority and Pathways for Wildlife to implement the Highway 152 permeability study, which is aimed at assessing impacts from the highway on wildlife species.
    - CDFW has been providing information to the High-Speed Rail Authority on elk biology and preliminary movement data to reduce or eliminate impacts to elk and improve public safety.
    - Forty-three GPS collars have been deployed on elk in different sub-groups inhabiting the San Luis Reservoir area. The collar data will supply detailed movement data to assess barriers, habitat usage, and provide a robust population estimate and sightability correction model. A detailed analysis with a focus on migration and stopovers is needed once the data collection phase is completed.
    - BLM actively manages habitats for Tule elk in the Hernandez Valley, including yellow star-thistle *(Centaurea solstitialis)* control in partnership with RMEF.

Research Needs

While CDFW has extensive history and telemetry data sets for ungulates, the scale and technology in which much of the data was collected does not allow for fine-scale movement analysis, Collection and analysis of movement data is a primary research priority for CDFW to inform management questions, such as improving our understanding of stopover areas, home ranges and survival; possible disease transmission pathways or locations that may have herd level impacts; habitat conservation priorities; and reduction of potential conflicts with vehicles.

Mule Deer, Mono Ecoregion, Deserts Province, X9a Deer Hunt Zone

- Specific need
  - Produce the Project Implementation Document (PID) for the Caltrans District 9 Wildlife Vehicle Collision Reduction Project
- Details of the need
  - $70,000
  - Funding to cover the cost of the PID which is a prerequisite to project implementation.
- How responding to the need will result in immediate progress
  - Completion of the PID will allow the process of the Caltrans District 9 Wildlife Vehicle Collision Reduction Project to move forward to the next stage.
- Specific need
  - Identify a funding source for Caltrans District 9 Wildlife Vehicle Collision Reduction Project (Highway 395 corridor between State Route 203 and Crowley Lake area).
- Details of the need
  - $48,012,604
  - Funding for the cost of Concept 6 as identified in the Caltrans District 9 Wildlife Vehicle Collision Reduction- Feasibility Study Report.
- How responding to the need will result in immediate progress
  - The next step in the process for accomplishing Concept 6 as outlined in the Caltrans District 9 Wildlife Vehicle Collision Reduction Project can begin once the PID is completed.

Mule Deer, Sierra Nevada Ecoregion, Central Valley and Sierra Nevada Province, X6a, X6b, X7a, and X7b Deer Hunt Zones

- Specific need
  - High-resolution, long-term movement data for deer in areas where crossings are most needed. High-use corridors and stopover locations must be identified, connected and protected. Data will also identify response to climate change and barriers.
- Details of the need
  - $295,150
  - 6 Funding to cover the cost of

        - 60 satellite GPS collars, battery replacements
            - $131,400
            - $750
        - Collar service fees (air time)
            - $18,000 ($100/collar/year x 3 years)
        - Capture of 60 deer in each larger area by a contracted professional net gun crew on winter range
            - $40,000 requested
        - Contract seasonal services for analyses
            - $105,000 ($50,000 per year x 3 years)
- How responding to the need will result in immediate progress
    - Immediate collection of location data for delineation of deer migratory corridors prior to any future wildfires, developments, effects from climate change, barriers.
    - Provide empirical data in response to internal and external requests for information about deer habitat use in areas currently experiencing development pressure.
    - Begin building datasets needed to provide state and federal land managers with deer habitat use information vital to meaningful planning and implementation of successful habitat management activities and road mortality mitigation.
    - Begin work to estimate survival parameters that are a critical part of development and implementation of zone-wide deer population models.
    - Deliverables will inform management decisions and improve our ability to communicate agency priorities in habitat management to the public, state wildlife commissioners, and sister agencies such as Caltrans.
- Technical assistance
    - Contracted seasonal costs would cover assistance with data analysis, tracking collars, mapping and reporting.

Roosevelt Elk, Northern California Coast Ecoregion, North Coast and Klamath Province

- Specific need
    - Long-term habitat utilization and movement data is necessary to identify locations for roadway modifications to allow for increased roadway safety.
        - The Washington Department of Transportation installed elk crossing signs with flashing beacons that utilize stationary receivers to detect collared elk. This system was operational in 2000 along a stretch of Highway 101 and a subsequent decrease in collisions were observed even with an increase in traffic volume and a speed limit increase (K. McAllister, Washington Department of Transportation, unpublished report).
    - Humboldt and Del Norte counties contain a significant amount of suitable habitat that is unoccupied by elk. The Department aims to achieve a robust and well-distributed elk population in areas where elk depredation conflicts are minimal and provide for public use opportunities.
        - Private lands where the presence of elk may be tolerated or encouraged include timberlands, ownerships enrolled in the Private Lands

Management Program (PLM), and other properties where elk are desired by the landowner. Where conflicts occur, management actions should be implemented to alleviate conflicts while maintaining a viable overall elk population. Where suitable, unoccupied elk habitat exists, management actions should facilitate natural dispersal or through translocations to re¬ establish elk where conflicts will be minimal.

- Data is needed on habitat utilization and movement of elk in this area to inform future management efforts to encourage range expansion of elk onto suitable public lands.

> Details of the need
  - o $388,869
  - o Funding to cover the cost of;
    - GPS collars and data
    - Helicopter capture efforts
    - Roadway warning systems

	Units Needed	Unit Price	Total Cost
Vectronic - Survey-2D IR collar	60	$1,293.00	$77,580.00
USB Bluetooth Stick	1	$90.00	$90.00
Activation	60	$30.00	$1,800.00
Data Fee - 5 years	60	$450.00	$27,000.00
Freight	1	$1,609.00	$1,609.00
Vectronic - Vertex Plus-3 collar	20	$2,534.00	$50,680.00
Data Fee - 2 years	20	$780.48	$15,609.60
Freight	1	$500.00	$500.00
Subtotal			$174,868.60
Helicopter Capture Efforts			
Rotor Hours (5 Days)	42	$2,000.00	$84,000.00
Subtotal			$84,000.00
Roadway Warning System (per 3 mile stretch of roadway)			
Sign construction, installation, electrical service	2	$50,000.00	$100,000.00
Telemetry receiver stations	2	$15,000.00	$30,000.00
Subtotal			$130,000.00
Equipment Grand Total			$388,868.60

> How responding to the need will result in immediate progress
  - o Collars will be deployed on additional individuals along Highway 101 and countywide. This will allow the CDFW to:
  - o Determine daily use corridors and hotspots of activity along Highway 101
    - Indicate need for an adequate wildlife crossing warning system.
    - Implement and test a crossing warning system at two locations, one in Del Norte and one in Humboldt County.

        - Improve safety conditions for drivers and wildlife along Highway 101.
    - Determine suitable habitat
        - Properly assess range expansion of elk onto public lands.
        - Justify management actions in the future to facilitate natural dispersal or translocations of elk where conflicts will be minimal.
    - Increase the CDFW's understanding of population size, population growth, movements, and habitat use of Roosevelt elk in Del Norte and Humboldt counties. Although elk populations have increased since the 1960s, large areas of suitable habitat remain unoccupied in northern California. Habitat selection and factors limiting population growth and expansion have largely been unstudied. Examining elk demographics and habitat selection is needed to better enhance the CDFW's ability to manage and conserve elk in the northern part of the state.

Tule Elk, Central Valley and Sierra Nevada Province and Bay Delta and Central Coast Province, San Luis Reservoir Hunt Zone

- Specific need
    - Additional funding for data analysis is needed. High-resolution movement data for this project has been collected. The collar data will supply detailed movement data to assess barriers, habitat usage, and provide a robust population estimate and sightability correction model. A detailed analysis with a focus on migration and stopovers is needed.
- Details of the need
    - $150,000
    - Contract seasonal services for analyses
        - $150,000 ($50,000 per year x 3 years)
- How responding to the need will result in immediate progress
    - Provide empirical data in response to internal and external requests for information about tule elk habitat use in areas currently experiencing habitat fragmentation.
    - Begin building datasets needed to provide state and federal land managers with tule elk habitat use information vital to meaningful planning and implementation of successful habitat management activities and road mortality mitigation.
    - Begin work to estimate survival parameters that are a critical part of development and implementation of zone-wide tule elk population models.
        - Deliverables will inform management decisions and improve our ability to communicate agency priorities in habitat management to the public, state wildlife commissioners, and sister agencies such as Caltrans;
- Technical assistance
    - Contracted seasonal costs would cover assistance with data analysis, mapping and reporting.

Literature Cited

Caltrans. 2016. Caltrans District 9 Wildlife Vehicle Collision Reduction – Feasibility Study Report. EA: 09-987111

Hurley, M. A., and G. A. Sargeant. 1991. Effects of hunting and land management on elk habitat use, movement patterns, and mortality in western Montana. Pages 10-12 in. Montana State University, Bozeman, Montana.

Leptich, D. J., and P. Zager. 1991. Road access management effects on elk mortality and population dynamics. Pages 126-137 in. Proceedings in elk vulnerability symposium. Montana State University, Bozeman, Montana.

Leptich, D. J., S. G. Hayes, and P. E, Zager. 1995. Coeur D'Alene Elk Ecology. Idaho Department of Fish and Game.

Lyon, L. J., and J. E. Canfield. 1991. Habitat selections by Rocky Mountain elk under hunting season stress. Pages 99-105 in. Montana State University, Bozeman, Montana.

Shilling, F. and D. Waetjen. 2016. Impact of Wildlife-Vehicle Conflict on Drivers and Animals. University of California Davis, UC Davis Road Ecology Center. https://roadecology.ucdavis.edu/files/content/news/CA_WVC_Hotspots_2016.pdf. Accessed 05 October 2018.

Shilling, F., Waetjen, D., and K. Harrold. 2017. Impact of Wildlife-Vehicle Conflict on Drivers and Animals. University of California Davis, UC Davis Road Ecology Center. https://roadecology.ucdavis.edu/files/content/news/CROS-CHIPs_Hotspots_2017_ES2.pdf. Accessed 05 October 2018.

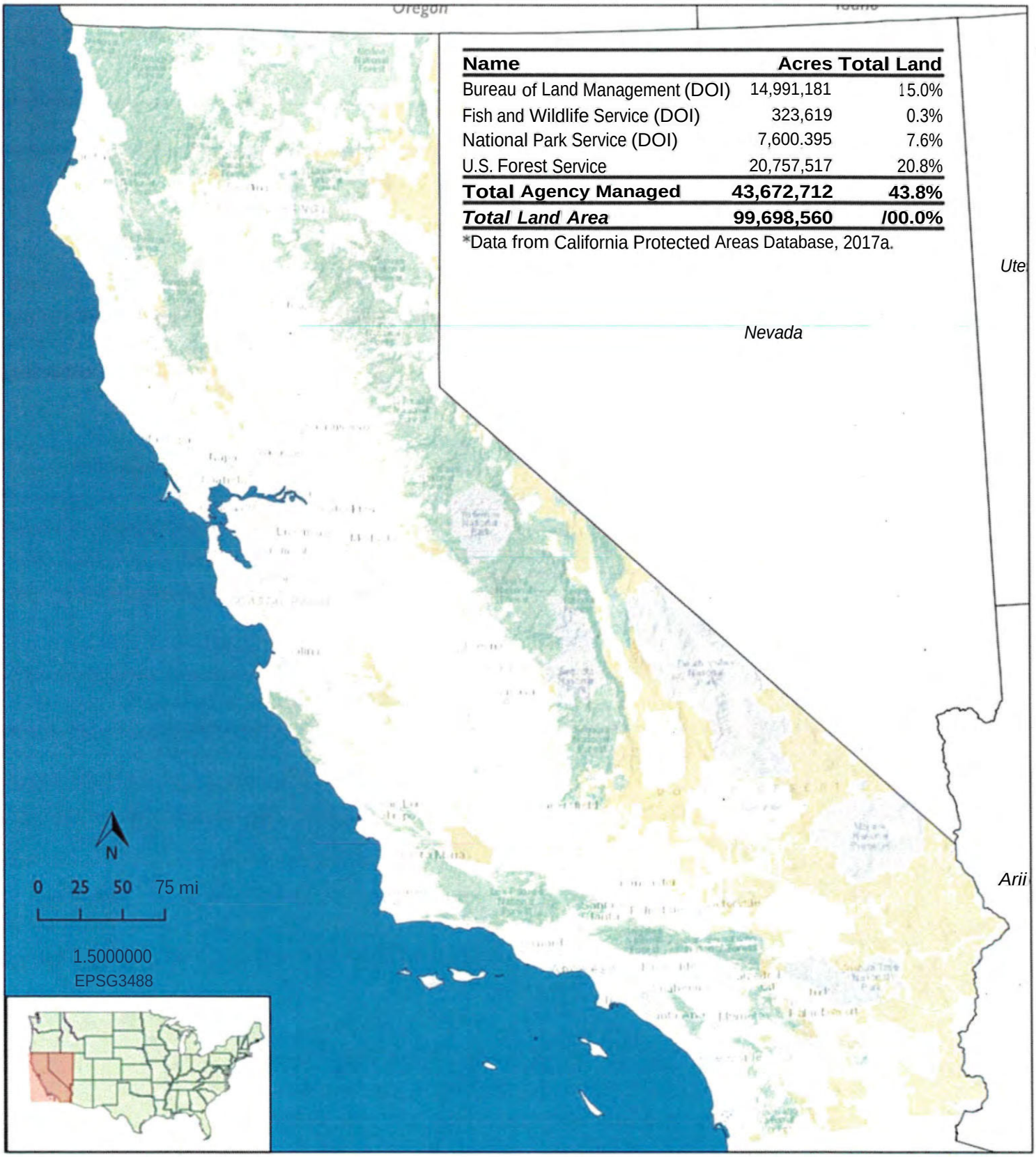
Unsworth, J. W., L. Kuck, M. D. Scott, and E. O. Garton. 1993. Elk Mortality in the Clearwater Drainage of Northcentral Idaho. The Journal of Wildlife Management 57:495.

U.S. Department of the Interior

California Surface Management Areas

Name	Acres	Total Land
Bureau of Land Management (DOI)	14,991,181	15.0%
Fish and Wildlife Service (DOI)	323,619	0.3%
National Park Service (DOI)	7,600.395	7.6%
U.S. Forest Service	20,757,517	20.8%
Total Agency Managed	**43,672,712**	**43.8%**
Total Land Area	**99,698,560**	**/00.0%**

*Data from California Protected Areas Database, 2017a.



Legend

- Bureau of Land Management
- National Park Service
- U.S. Fish & Wildlife Service
- U.S. Forest Service

No warranty is made by the U.S. Fish & Wildlife Service as to the accuracy, reliability, or completeness of these data. Orgmal data were compiled from various sources. This information may not meet National Map Accuracy Standards. This project was developed through digital means and may be updated without notice.

Figure 1. Federal surface management distribution in California for Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, and U.S. Forest Service.

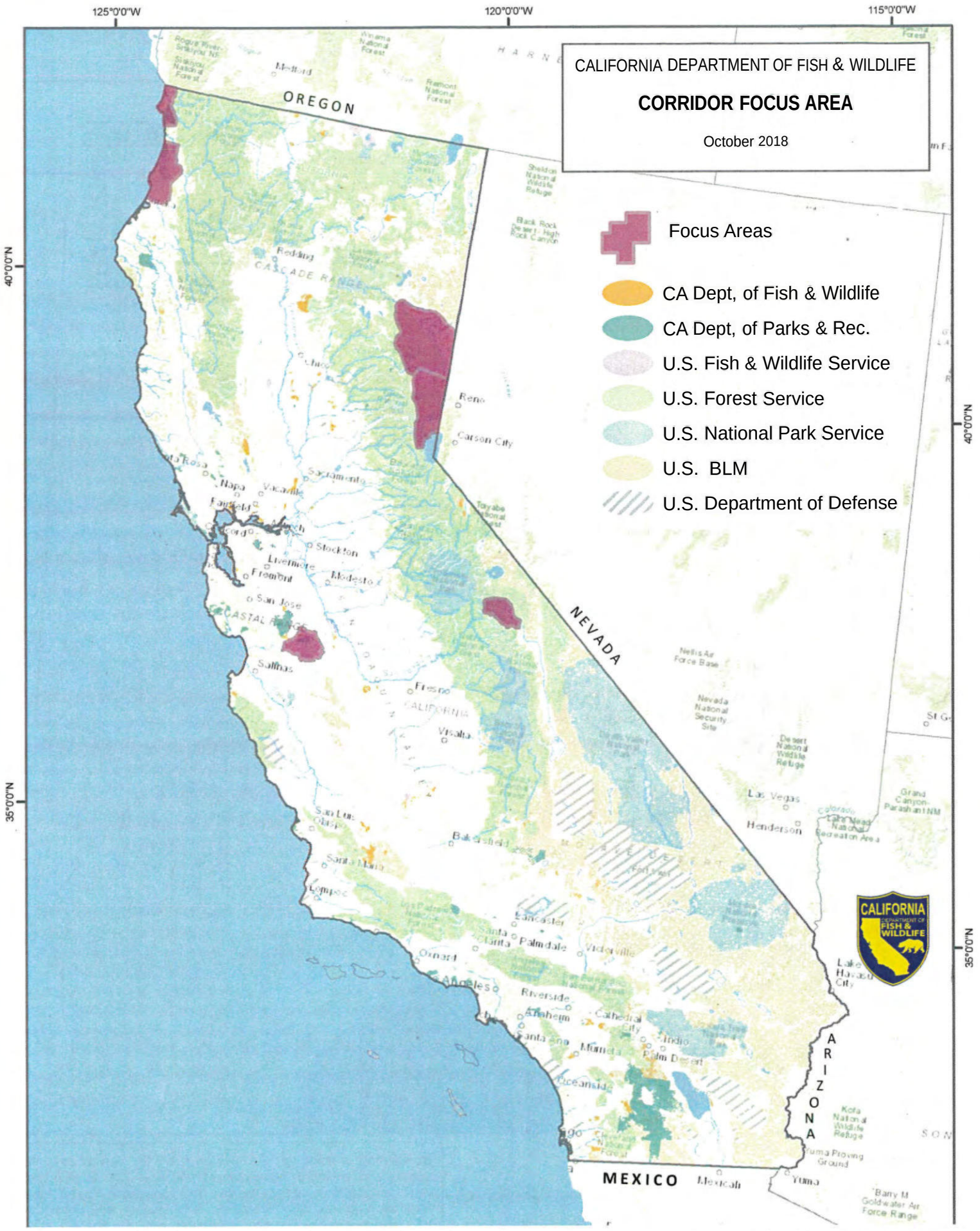
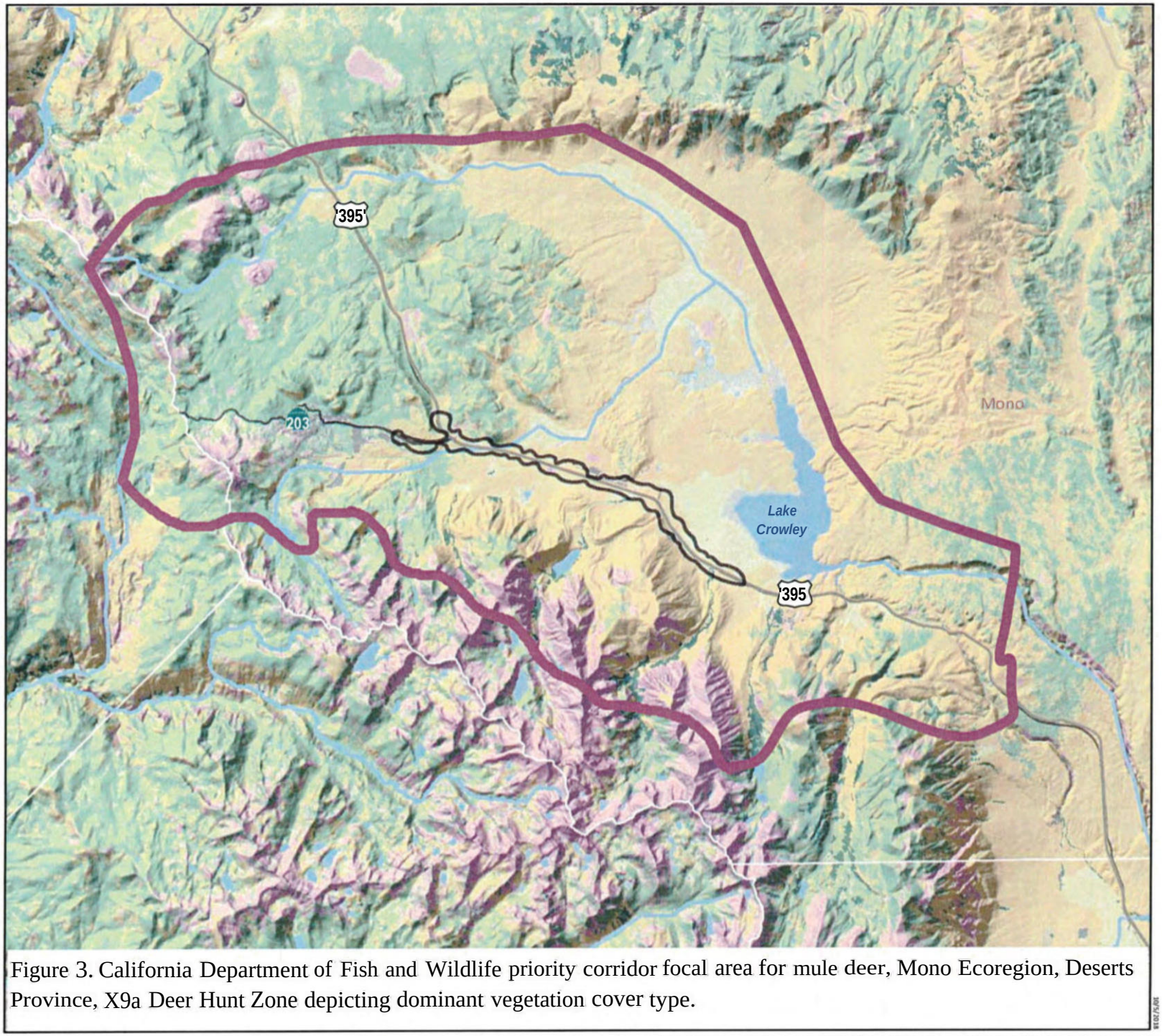


Figure 2. California Department of Fish and Wildlife corridor focus areas in response to U.S. Department of Interior's Secretarial Order 3362.

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE



HIGHWAY 203 TO LAKE CROWLEY

Land Cover

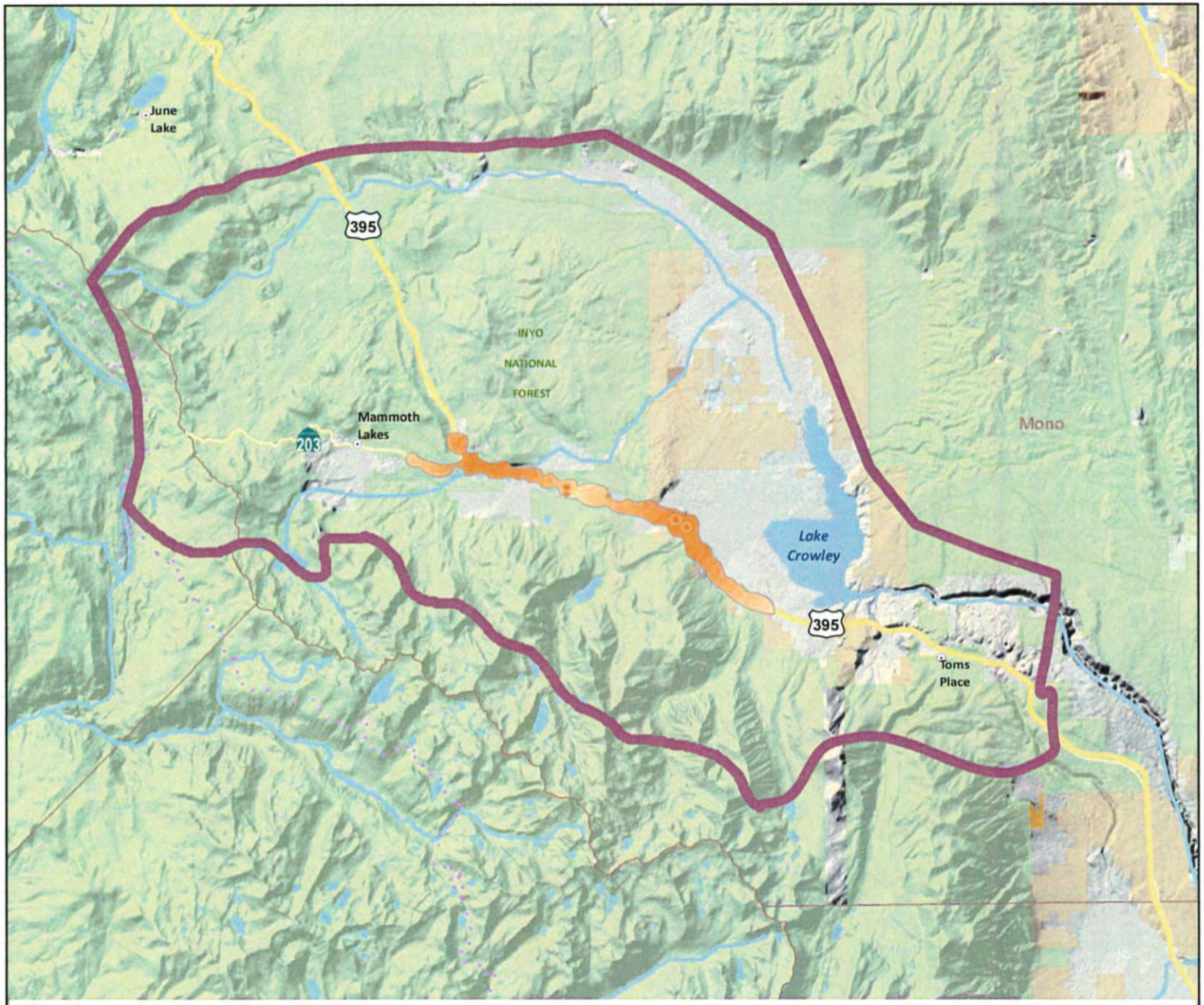
Focus Area
Focus Region
Conifer
Hardwood
Agriculture
Barren/Other
Herbaceous
Shrub
Urban

County Boundary
Waterbody
Ephemeral or dry lake



Figure 3. California Department of Fish and Wildlife priority corridor focal area for mule deer, Mono Ecoregion, Deserts Province, X9a Deer Hunt Zone depicting dominant vegetation cover type.

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE



HIGHWAY 203 TO LAKE CROWLEY

Land Ownership

- Focus Area
- Focus Region
- CA Dept of Fish & Wildlife
- CA Dept. of Parks & Rec.
- U.S. Fish & Wildlife Service
- U.S. Forest Service
- U.S. National Park Service
- U.S. BLM



Figure 4. California Department of Fish and Wildlife priority corridor focal area for mule deer, Mono Ecoregion, Deserts Province, X9a Deer Hunt Zone depicting land management agency jurisdiction.

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE



MULE DEER
DOYLE HERD

Land Cover

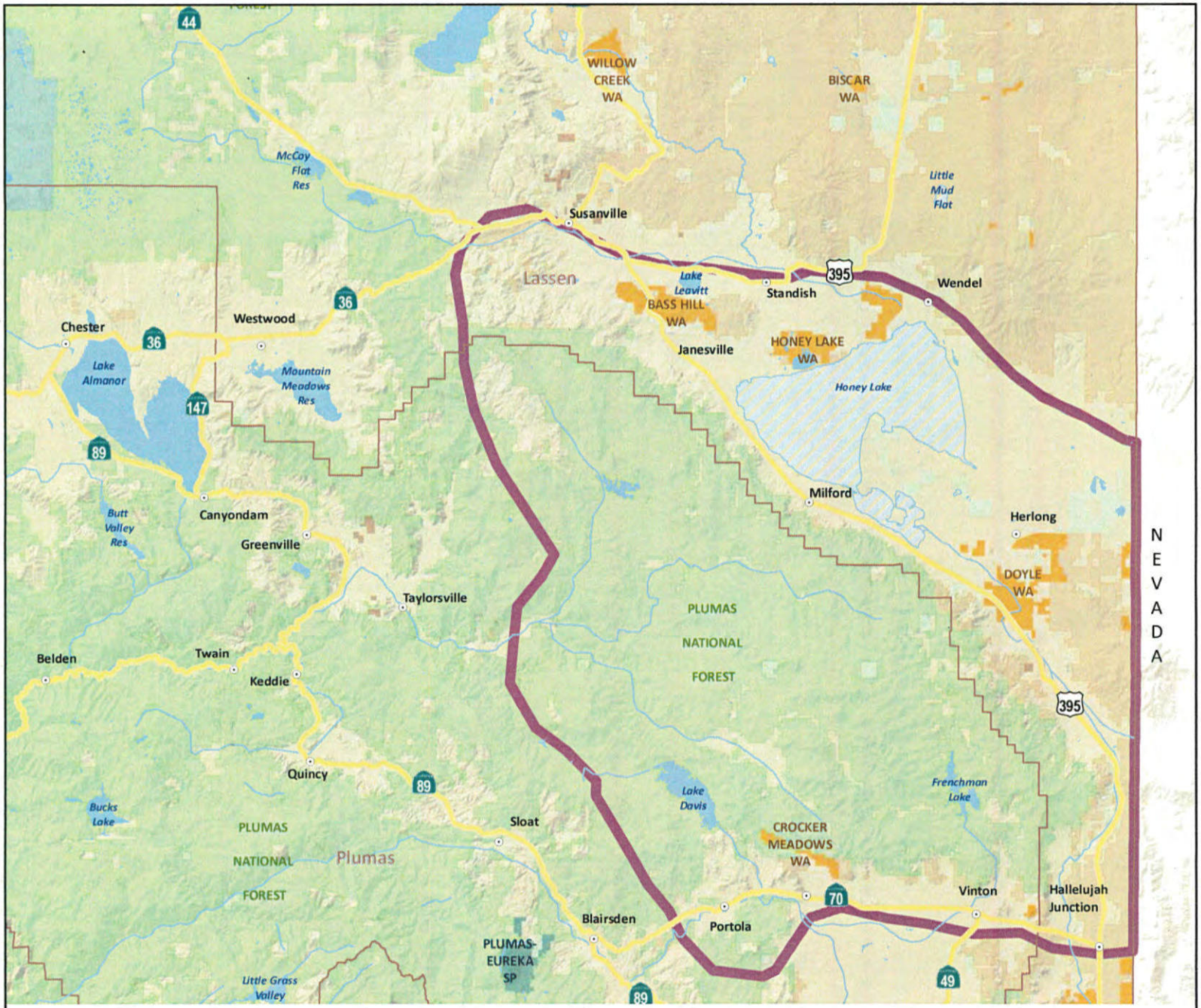
- Doyle Herd-Focus Area
- Conifer
- Hardwood
- Agriculture
- Barren/Other
- Herbaceous
- Shrub
- Urban

- County Boundary
- Waterbody
- Ephemeral or dry lake



Figure 5. California Department of Fish and Wildlife priority corridor focal area for mule deer, Sierra Nevada Ecoregion-Central Valley and Sierra Nevada Province, X6a, X6b, and X7a Deer Hunt Zones depicting dominant vegetation cover type.

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE



MULE DEER DOYLE HERD

Land Ownership

- Doyle Herd-Focus Area
- CA Dept. of Fish & Wildlife
- CA Dept. of Parks & Rec.
- U.S. Fish & Wildlife Service
- U.S. Forest Service
- U.S. National Park Service
- U.S. BLM



Figure 6. California Department of Fish and Wildlife priority corridor focal area for mule deer, Sierra Nevada Ecoregion-Central Valley and Sierra Nevada Province, X6a, X6b, and X7a Deer Hunt Zones depicting land management agency jurisdiction.

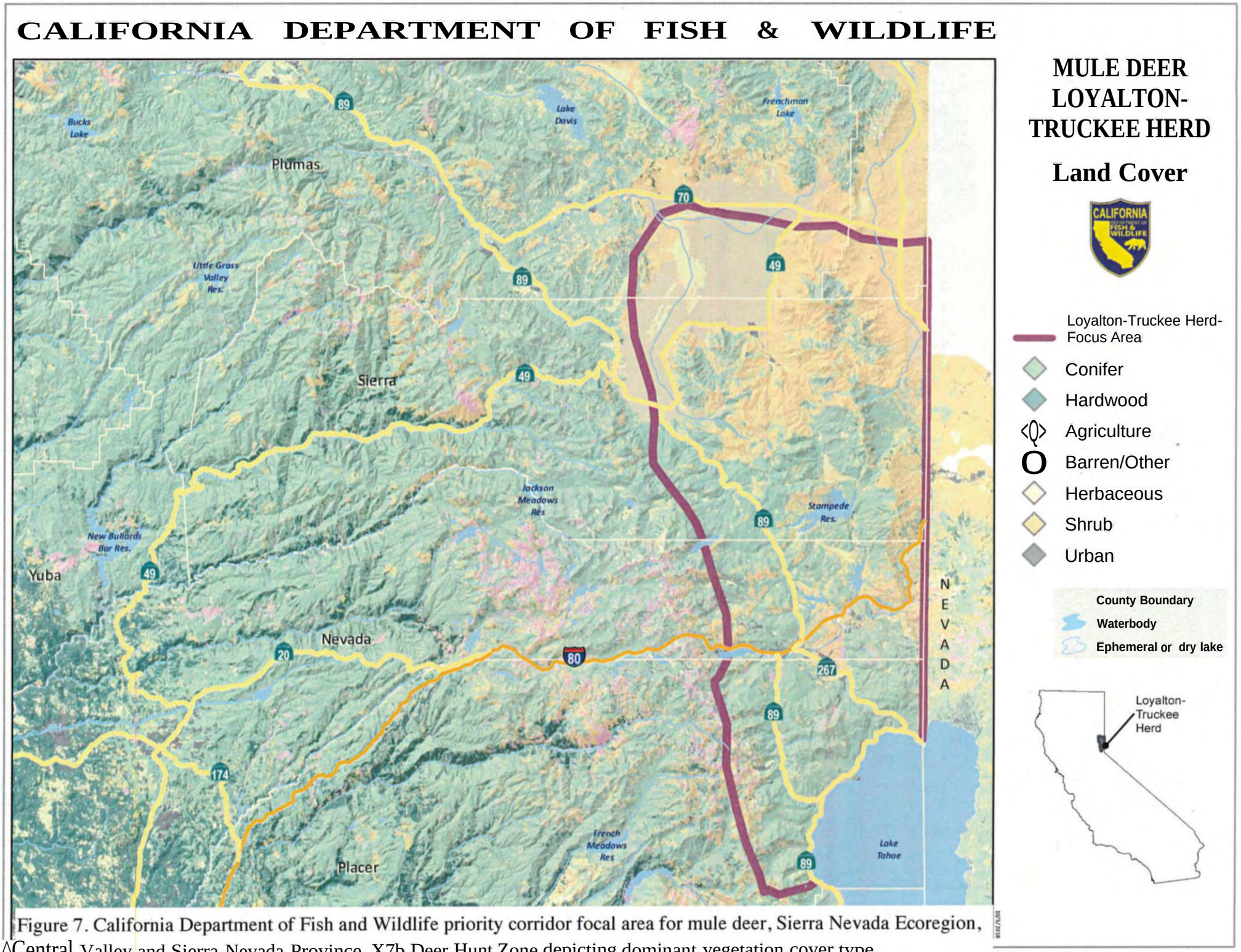


Figure 7. California Department of Fish and Wildlife priority corridor focal area for mule deer, Sierra Nevada Ecoregion, ^Central Valley and Sierra Nevada Province, X7b Deer Hunt Zone depicting dominant vegetation cover type.

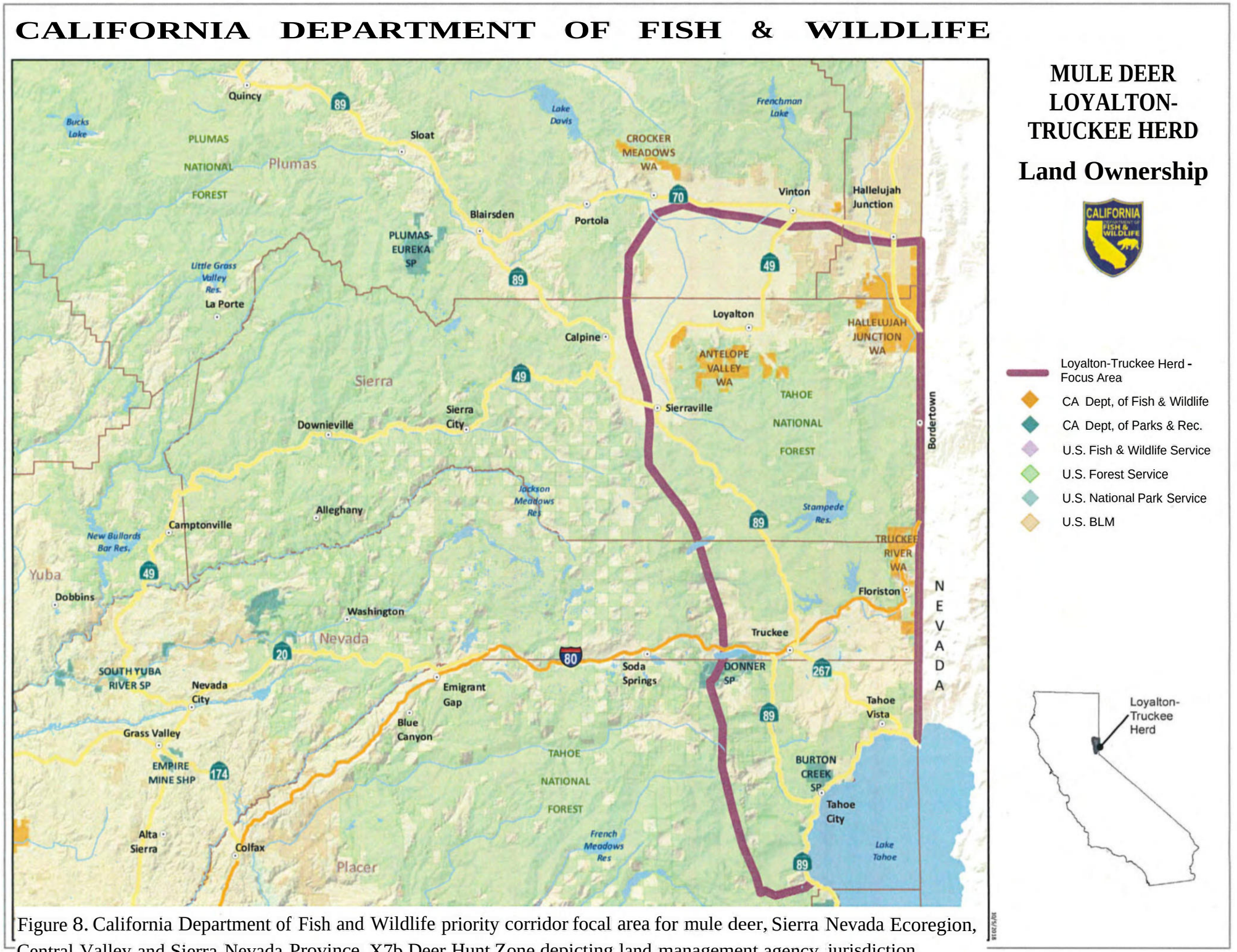


Figure 8. California Department of Fish and Wildlife priority corridor focal area for mule deer, Sierra Nevada Ecoregion, Central Valley and Sierra Nevada Province, X7b Deer Hunt Zone depicting land management agency jurisdiction.

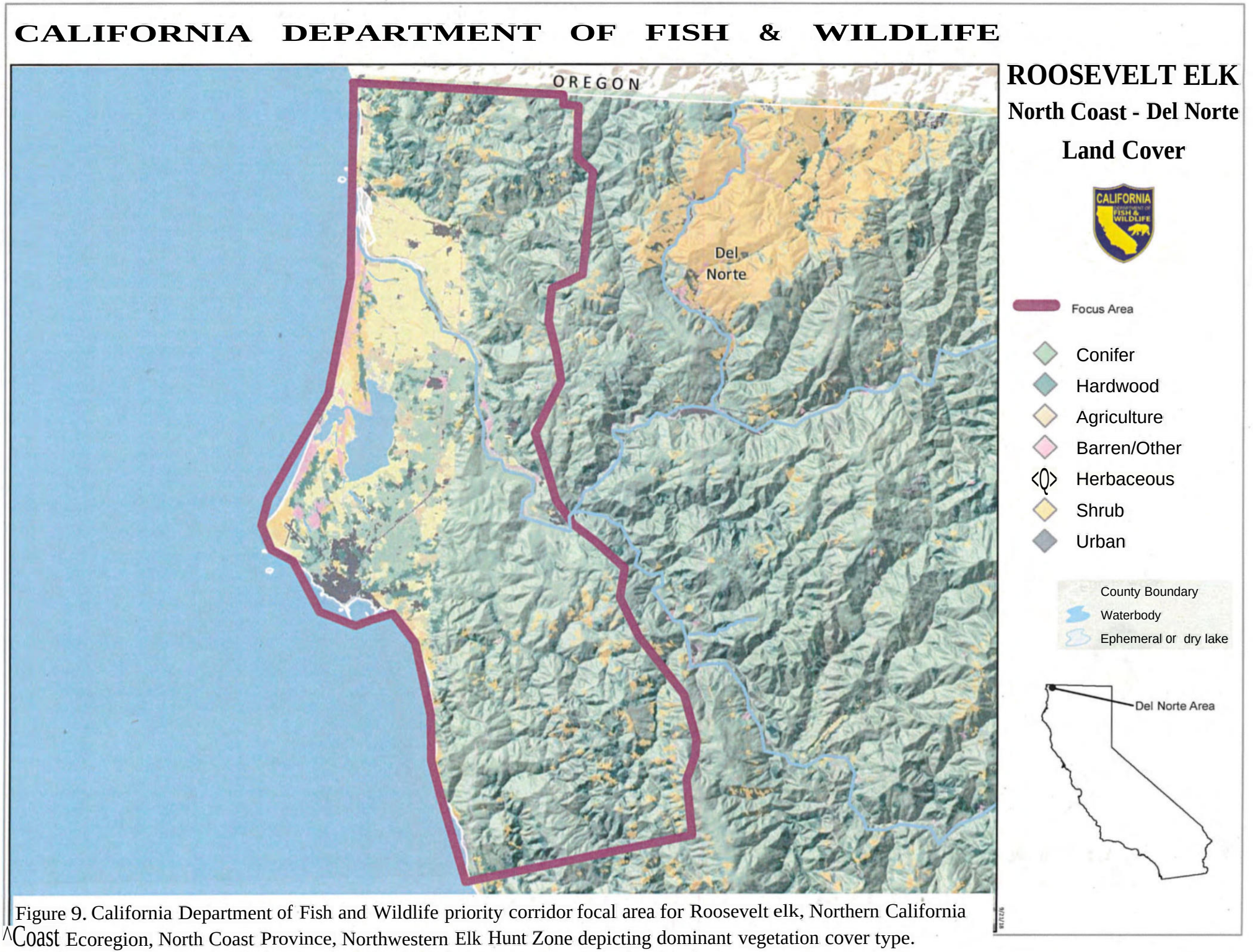


Figure 9. California Department of Fish and Wildlife priority corridor focal area for Roosevelt elk, Northern California Coast Ecoregion, North Coast Province, Northwestern Elk Hunt Zone depicting dominant vegetation cover type.

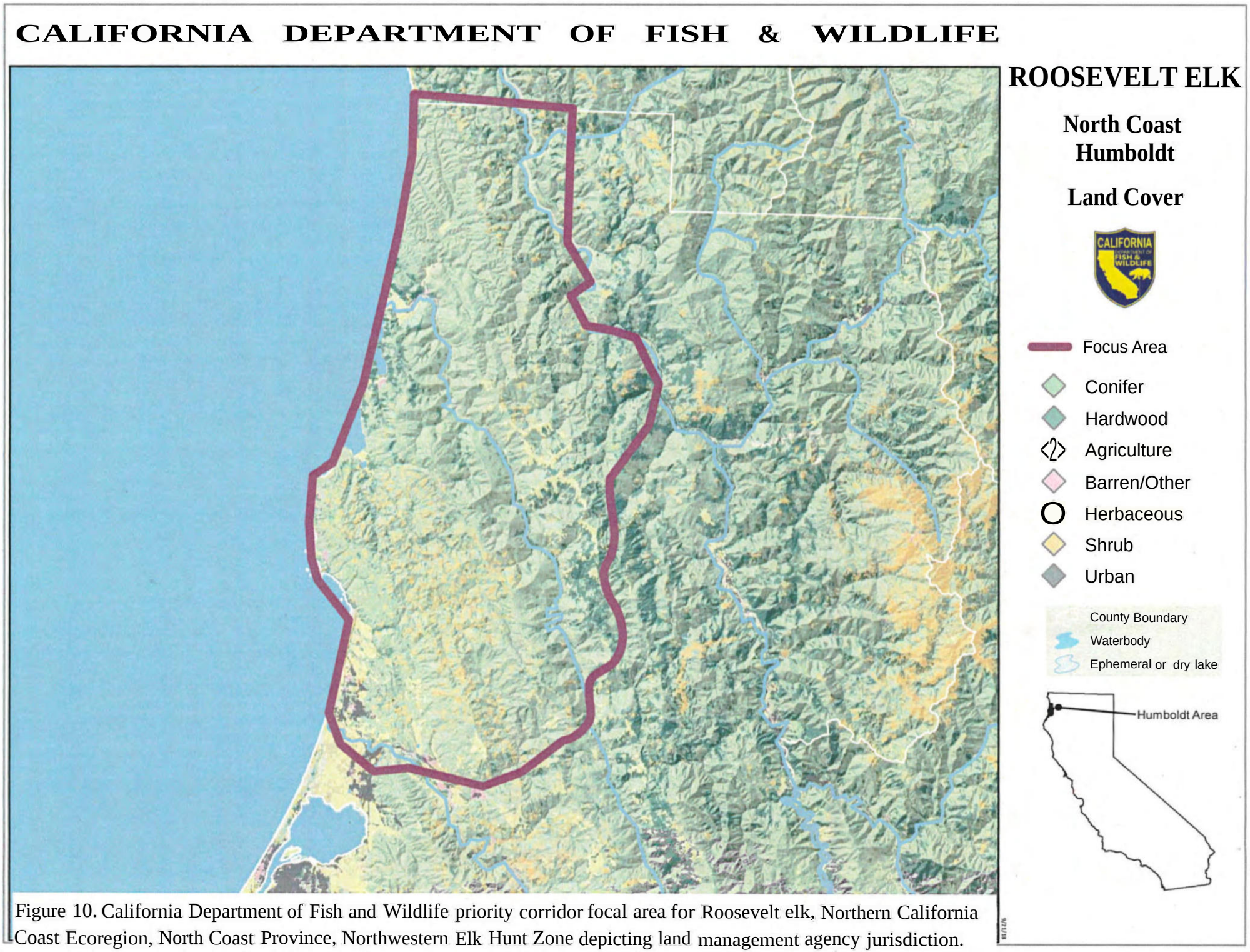


Figure 10. California Department of Fish and Wildlife priority corridor focal area for Roosevelt elk, Northern California Coast Ecoregion, North Coast Province, Northwestern Elk Hunt Zone depicting land management agency jurisdiction.

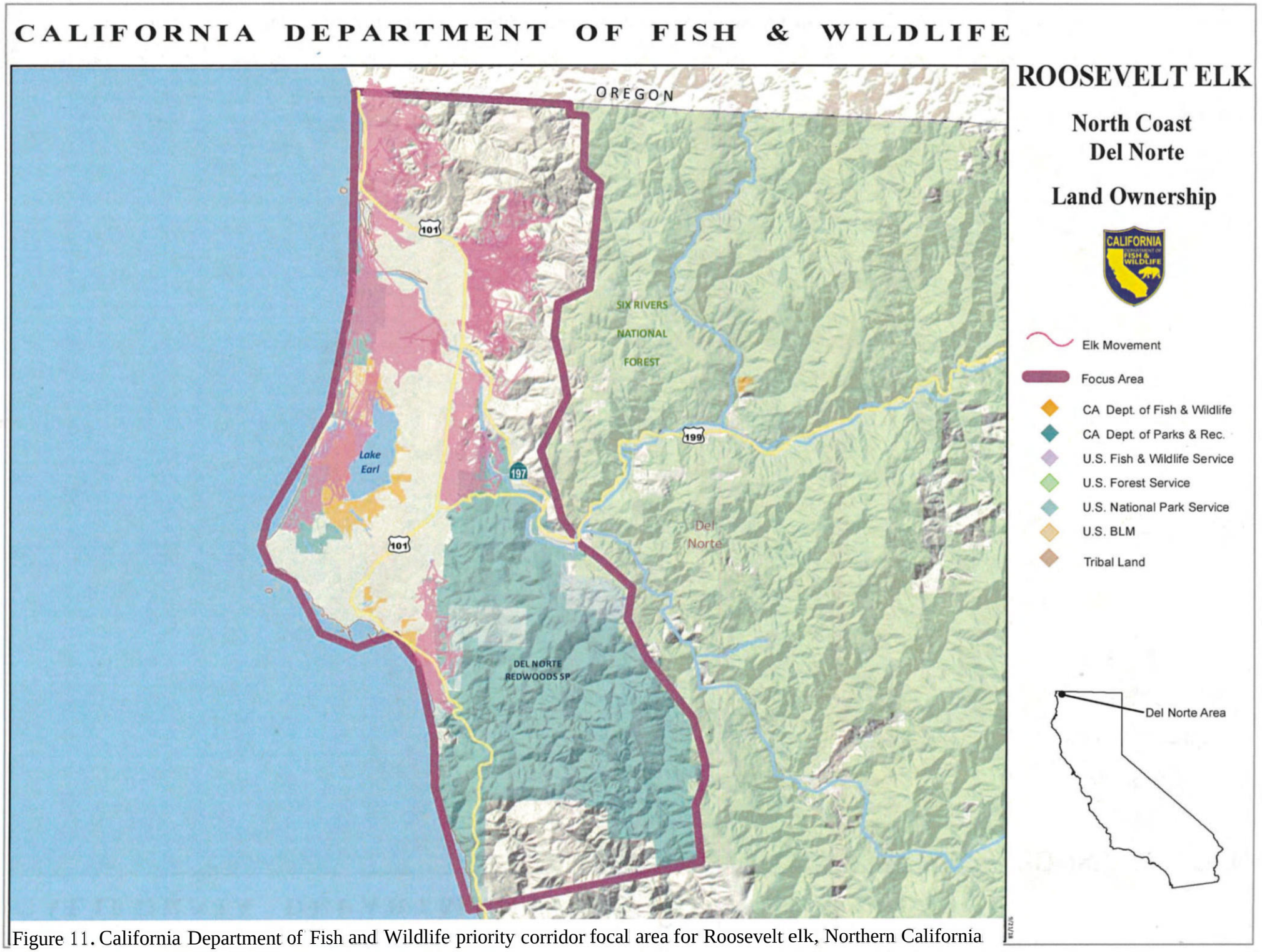


Figure 11. California Department of Fish and Wildlife priority corridor focal area for Roosevelt elk, Northern California Coast Ecoregion, North Coast Province, Northwestern Elk Hunt Zone, jurisdictional land management agency jurisdiction

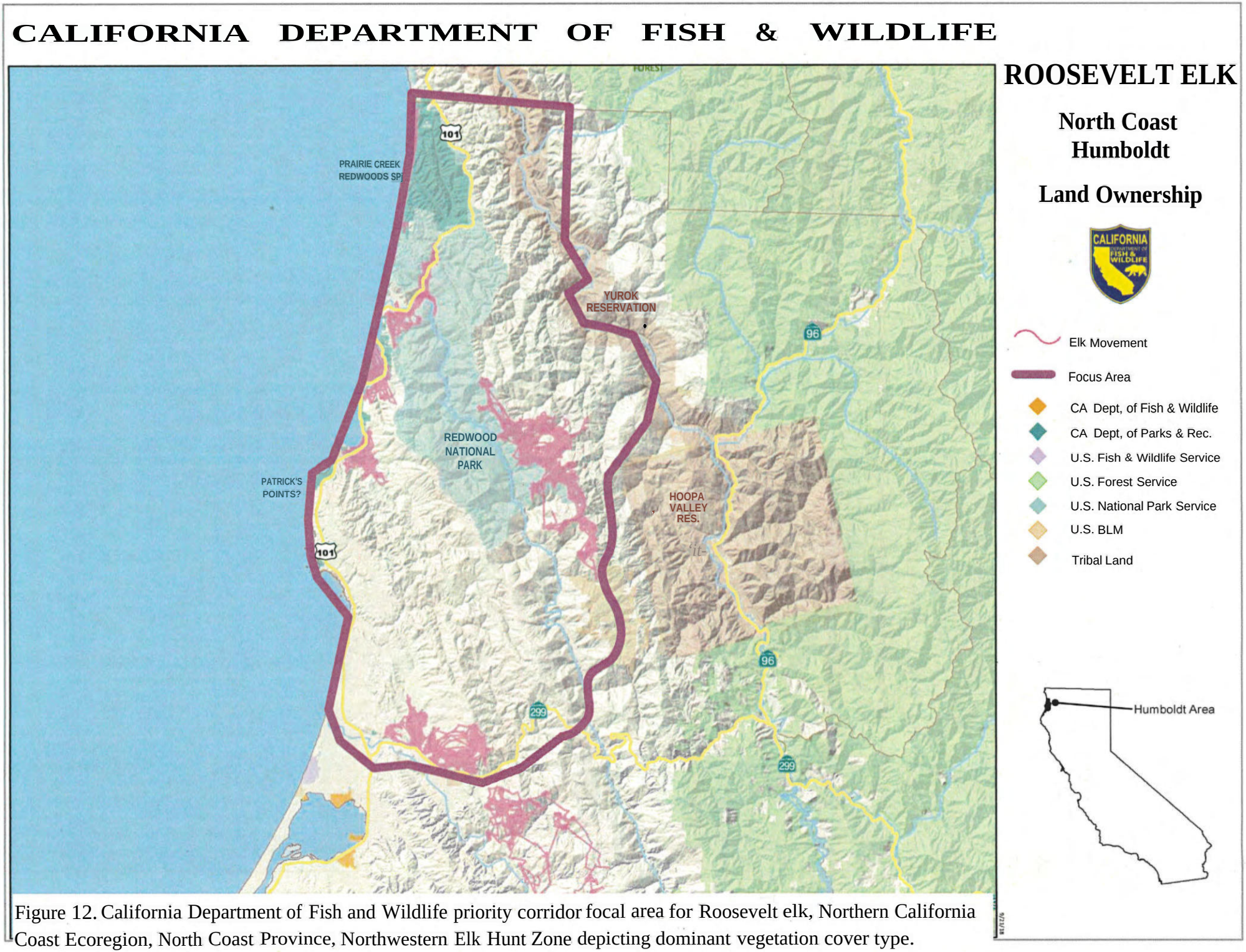
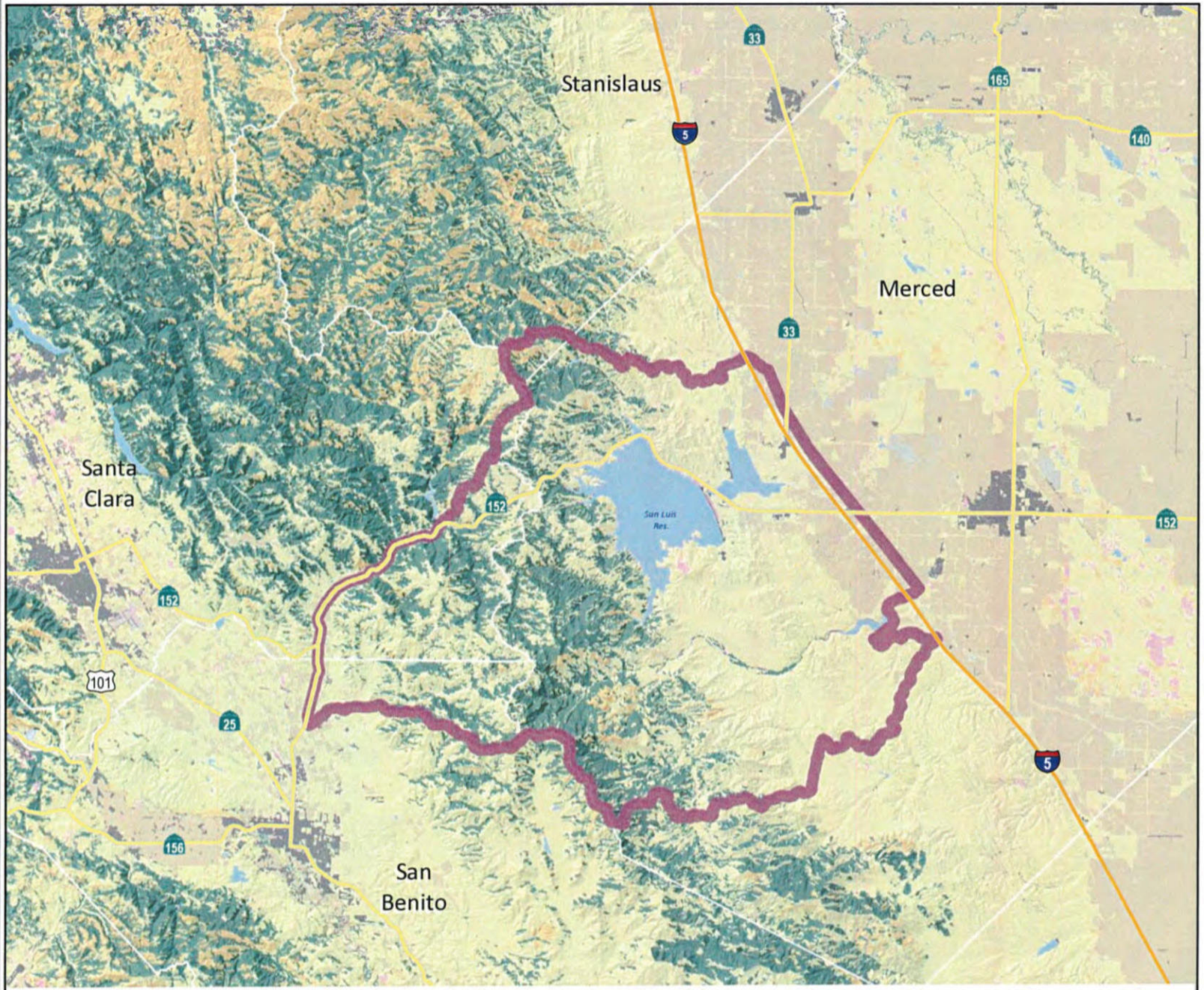


Figure 12. California Department of Fish and Wildlife priority corridor focal area for Roosevelt elk, Northern California Coast Ecoregion, North Coast Province, Northwestern Elk Hunt Zone depicting dominant vegetation cover type.

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE



TULE ELK
San Luis Reservoir
Land Cover

- Focus Area
- Conifer
- Hardwood
- Agriculture
- Barren/Other
- Herbaceous
- Shrub
- Urban

- County Boundary
- Vteterbody
- Ephemeral or dry lake



Figure 13. California Department of Fish and Wildlife priority corridor focal area for Tule elk, Central Valley and Sierra Nevada Province and Bay Delta and Central Coast Province, San Luis Reservoir Elk Hunt Zone depicting dominant vegetation cover type.

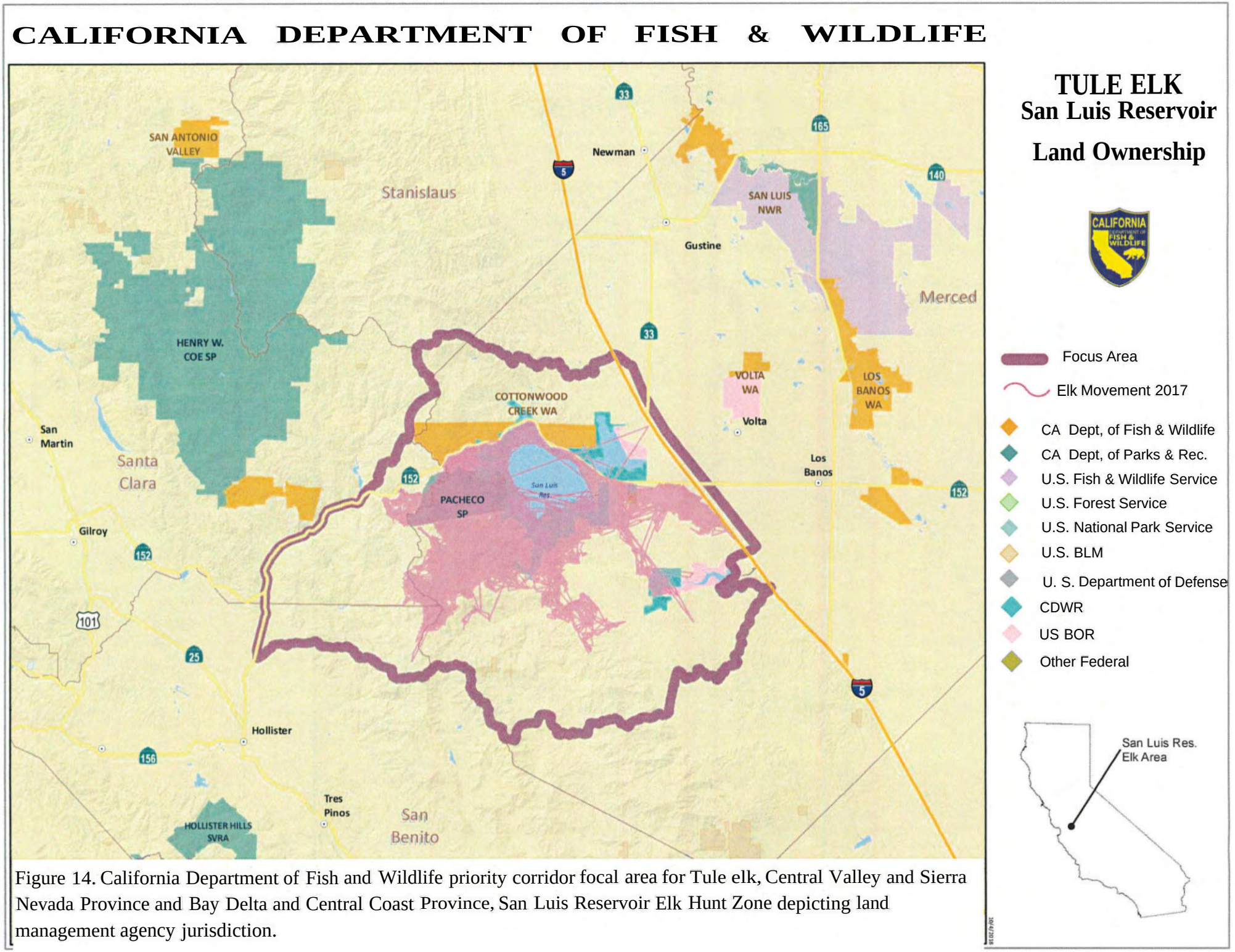


Figure 14. California Department of Fish and Wildlife priority corridor focal area for Tule elk, Central Valley and Sierra Nevada Province and Bay Delta and Central Coast Province, San Luis Reservoir Elk Hunt Zone depicting land management agency jurisdiction.

Appendix A. Secretarial Order 3362

ORDER NO. 3362

Subject: Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors

Sec. 1 **Purpose.** This Order directs appropriate bureaus within the Department of the Interior (Department) to work in close partnership with the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming to enhance and improve the quality of big-game winter range and migration corridor habitat on Federal lands under the management jurisdiction of this Department in **a way** that recognizes state authority to conserve and manage big-game species and respects private property rights. Through scientific endeavors and land management actions, wildlife such as Rocky Mountain Elk (elk), Mule Deer (deer), Pronghorn Antelope (pronghorn), and a host of other species will benefit. Additionally, this Order seeks to expand opportunities for big-game hunting by improving priority habitats to assist states in their efforts to increase and maintain sustainable big game populations across western states.

Sec. 2 **Authorities.** This Order is issued under the authority of section 2 of Reorganization Plan No. 3 of 1950 (64 Stat. 1262), as amended, as well as the Department's land and resource management authorities, including the following:

a. Federal Land Policy and Management Act of 1976, as amended, 43 U.S.C. 1701, *et seq.',*

b. U.S. Geological Survey Organic Act, as amended, 43 U.S.C. 31, *etseq.;*

c. National Wildlife Refuge System Improvement Act of 1997, as amended, 16 U.S.C. 668dd *etseq.-,* and

d. National Park Service Organic Act of 1916, as amended, 54 U.S.C. 100101, *etseq.*

Sec. 3 **Background.** The West was officially "settled" long ago, but land use changes continue to occur throughout the western landscape today. Human populations grow at increasing rates with population movements from east and west coast states into the interior West. In many areas, development to accommodate the expanding population has occurred in important winter habitat and migration corridors for elk, deer, and pronghorn. Additionally, changes have occurred across large swaths of land not impacted by residential development. The habitat quality and value of these areas crucial to western big-game populations are often degraded or declining.

The Bureau of Laud Management (BLM) is the largest land manager in the United States (U.S.) with more than 245 million acres of public land under its purview, much of which is found in Western States. The U.S. Fish and Wildlife Service (FWS) and National Park Service (NPS) also manage a considerable amount of public land on behalf of the American people in the West. Beyond land management responsibilities, the Department has strong scientific capabilities in the U.S. Geological Survey (USGS) that can be deployed to assist State wildlife agencies and Federal land managers. Collectively, the appropriate bureaus within the Department have an opportunity to serve in a leadership role and take the initiative to work closely with Western States on their priorities and objectives as they relate to big-game winter range and migration corridors on lands managed by the Department.

Consistent with the American conservation ethic, ultimately it is crucial that the Department take action to harmonize State fish and game management and Federal land management of big-game winter range and corridors. On lands within these important areas, if landowners are interested and willing, conservation may occur through voluntary agreements.

Robust and sustainable elk, deer, and pronghorn populations contribute greatly to the economy and well-being of communities across the West. In fact, hunters and tourists travel to Western States from across our Nation and beyond to pursue and enjoy this wildlife. In doing so, they spend billions of dollars at large and small businesses that are crucial to State and local economies. We have a responsibility as a Department with large landholdings to be a collaborative neighbor and steward of the resources held in trust.

Accordingly, the Department will work with our State partners and others to conserve and/or improve priority western big-game winter range and migration corridors in sagebrush ecosystems and in other ecotypes as necessary. This Order focuses on the Western States of: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. These States generally have expansive public lands with established sagebrush landscapes along with robust big-game herds that are highly valued by hunters and tourists throughout the Nation.

The Department has broad responsibilities to manage Federal lands, waters, and resources for public benefit, including managing habitat to support fish, wildlife, and other resources. Secretary's Order 3356, "Hunting, Fishing, Recreational Shooting, and Wildlife Conservation Opportunities and Coordination with States, Tribes, and Territories," (SO 3356) was issued on September 15, 2017. SO 3356 primarily focused on physical access to lands for recreational activities, particularly hunting and fishing. This Order is focused on providing access to big game animals by providing direction regarding land management actions to improve habitat quality for big-game populations that could help ensure robust big-game populations continue to exist. Further, SO 3356 includes a number of directives related to working with States and using the best available science to inform development of guidelines, including directing relevant bureaus to:

a. Collaborate with State, tribal, and territorial fish and wildlife agencies to attain or sustain State, tribal, and territorial wildlife population goals during the Department's land management planning and implementation, including prioritizing active habitat management

projects and funding that contributes to achieving wildlife population objectives, particularly for wildlife that is hunted or fished, and identifying additional ways to include or delegate to States habitat management work on Federal lands;

b. Work cooperatively with State, tribal, and territorial wildlife agencies to enhance State, tribe, and territorial access to the Department's lands for wildlife management actions;

c. Within 180 days, develop a proposed categorical exclusion for proposed projects that utilize common practices solely intended to enhance or restore habitat for species such as sage grouse and/or mule deer; and

d. Review and use the best available science to inform development of specific guidelines for the Department's lands and waters related to planning and developing energy, transmission, or other relevant projects to avoid or minimize potential negative impacts on wildlife.

This Order follows the intent and purpose of SO 3356 and expands and enhances the specific directives therein.

Sec. 4 **Implementation.** Consistent with governing laws, regulations, and principles of responsible public stewardship, I direct the following actions:

a. With respect to activities at the national level, I hereby direct the BLM, FWS, and NPS to:

(1) Within 30 days, identify an individual to serve as the "Coordinator" for the Department. The Coordinator will work closely with appropriate States, Federal agencies, nongovernmental organizations, and/or associations to identify active programs focused on big¬ game winter range and/or migration corridors. The programs are to be organized and cataloged by region and other geographic features (such as watersheds and principles of wildlife management) as determined by the Deputy Secretary, including those principles identified in the Department's reorganization plan.

(2) Within 45 days, provide the Coordinator information regarding:

(i) Past and current bureau conservation/restoration efforts on winter range and migration corridors;

(ii) Whether consideration of winter range and corridors is included in appropriate bureau land (or site) management plans;

(iii) Bureau management actions used to accomplish habitat objectives in these areas;

(iv) The location of areas that have been identified as a priority for conservation and habitat treatments; and

(v) Funding sources previously used and/or currently available to the bureau for winter range and migration corridor conservation/restoration efforts.

(3) Within 60 days, if sufficient land use plans are already established that are consistent with this Order, work with the Coordinator and each regional Liaison (see section 4b) to discuss implementation of the plans. If land use plans are not already established, work with the Coordinator and each regional Liaison to develop an Action Plan that summarizes information collected in section 4 (a) (1) and (2), establishes a clear direction forward with each State, and includes:

(i) Habitat management goals and associated actions as they are associated with big game winter range and migration corridors;

(ii) Measurable outcomes; and

(iii) Budgets necessary to complete respective action(s).

b. With respect to activities at the State level, I hereby direct the BLM, FWS, and NPS to:

(1) Within 60 days, identify one person in each appropriate unified region (see section 4a) to serve as the Liaison for the Department for that unified region. The Liaison will coordinate at the State level with each State in their region, as well as with the Liaison for any other regions within the State. The Liaison will schedule a meeting with the respective State fish and wildlife agency to assess where and how the Department can work in close partnership with the State on priority winter range and migration corridor conservation.

(2) Within 60 days, if this focus is not already included in respective land management plans, evaluate how land under each bureau's management responsibility can contribute to State or other efforts to improve the quality and condition of priority big-game winter and migration corridor habitat.

(3) Provide a report on October 1, 2018, and at the end of each fiscal year thereafter, that details how respective bureau field offices, refuges, or parks cooperated and collaborated with the appropriate State wildlife agencies to further winter range and migration corridor habitat conservation.

(4) Assess State wildlife agency data regarding wildlife migrations early in the planning process for land use plans and significant project-level actions that bureaus develop; and

(5) Evaluate and appropriately apply site-specific management activities, as identified in State land use plans, site-specific plans, or the Action Plan (described above), that conserve or restore habitat necessary to sustain local and regional big-game populations through measures that may include one or more of the following:

(i) restoring degraded winter range and migration corridors by removing encroaching trees from sagebrush ecosystems, rehabilitating areas damaged by fire, or treating exotic/invasive vegetation to improve the quality and value of these areas to big game and other wildlife;

(ii) revising wild horse and burro-appropriate management levels (AML) or removing horses and burros exceeding established AML from winter range or migration corridors if habitat is degraded as a result of their presence;

(iii) working cooperatively with private landowners and State highway departments to achieve permissive fencing measures, including potentially modifying (via smooth wire), removing (if no longer necessary), or seasonally adapting (seasonal lay down) fencing if proven to impede movement of big game through migration corridors;

(iv) avoiding development in the most crucial winter range or migration corridors during sensitive seasons;

(v) minimizing development that would fragment winter range and primary migration corridors;

(vi) limiting disturbance of big game on winter range; and

(vii) utilizing other proven actions necessary to conserve and/or restore the vital big-game winter range and migration corridors across the West.

c. With respect to science, I hereby direct the USGS to:

(1) Proceed in close cooperation with the States, in particular the Western Association of Fish and Wildlife Agencies and its program manager for the Crucial Habitat Assessment Tool, prior to developing maps or mapping tools related to elk, deer, or pronghorn movement or land use; and

(2) Prioritize evaluations of the effectiveness of habitat treatments in sagebrush communities, as requested by States or land management bureaus, and identified needs related to developing a greater understanding of locations used as winter range or migration corridors.

d. I further hereby direct the responsible bureaus and offices within the Department to:

(1) Within 180 days, to update all existing regulations, orders, guidance documents, policies, instructions, manuals, directives, notices, implementing actions, and any other similar actions to be consistent with the requirements in this Order;

(2) Within 30 days, provide direction at the state or other appropriate level to revise existing Federal-State memorandums of agreement to incorporate consultation with State agencies on the location and conservation needs of winter range and migration routes; and

(3) Consult with State wildlife agencies and bureaus to ensure land use plans are consistent and complementary to one another along the entire wildlife corridor in common instances where winter range or migration corridors span jurisdictional boundaries.

e. Heads of relevant bureaus will ensure that appropriate members of the Senior Executive Service under their purview include a performance standard in their respective current or future performance plan that specifically implements the applicable actions identified in this Order.

Sec. 5 **Management.** I hereby direct the Deputy Secretary to take is responsible for taking all reasonably necessary steps to implement this Order.

Sec. 6 **Effeet of Order.** This Order is intended to improve the internal management of the Department. This Order and any resulting reports or recommendations are not intended to, and do not create any right or benefit, substantive or procedural, enforceable at law or equity by a party against the United States, its departments, agencies, instrumentalities or entities, its officers or employees, or any other person. To the extent there is any inconsistency between the provision of this Order and any Federal laws or regulations, the laws or regulations will control.

Sec. 7 **Expiration Date.** This Order is effective immediately. It will remain in effect until its provisions are implemented and completed, or until it is amended, superseded, or revoked.

Secretary of the Interior

Date:

THE
DAVY
CROCKETT
RANCH

707/487-3835
P.O. Box 176
Smith River
CA 95567

October 5th, 2018

California Fish and Wildlife
Sacramento, CA

RE: Elk Management-Del Norte County

The Davy Crockett Ranch is a beef and past dairy ranch that is (has)operated for over 60 years on approximately 1,000 acres in the Smith River bottoms, north of the Dr. Fine Bridge. We also own and operate Crockett United Lily Growers, Inc. on another 267 acres in the same area.

The elk damage on the Davy Crockett Ranch and United Lily has been to fencing, lily fields, new seeded hay fields and pastureland for beef. When the elk go through our elk fence and into the lily field it is devastating. If lily bulbs are displaced they will not grow. Every lily bulb is hand planted. The manual labor and loss of products is in the thousands of dollars. We have no ability to be reimbursed for these damages.

The elk population is out of control in the Smith River bottoms. The herds are numerous and moving back and forth across the Smith River. This has not been a common occurrence so I attribute that to population. There is no way the Crockett Ranch can fence at the river as the lower end of the Crockett Ranch sustains flooding prior to the Smith River flood stage.

We are asking the department to increase tag allocation and manage your State properties.

Thank you,

Joyce Crockett

Joyce Crockett, Owner

Palmer Westbrook, Inc.
550 Westbrook Ln.
Smith River, CA. 95567
(707J-437-3843

Octobar5, 2018

To Whom it may concern:

My name is Matt Westbrook, i work for Palmer Westbrook, Inc. in Smith River Ga. We currently raise both dairy and beef cattle, irrigated pasture, hay production, & Easter lily bulbs. Our Agricultural production occurs mainly in the Smith River valley and Fort Dick area near crescent city.

The Roosevelt elk population has been a significant problem for agricultural production for at least the last 10 years. Even more aggressive and damaging with greater occurrence in the last 5 years.

Most damages occur within livestock fencing. Replacement, maintaining, and rebuilding new fences occurs every year. This consists of hired labor, fence posts, barb wire, hot wire, staples, gates and equipment

With damaged fences you get livestock mixed up or missing. Mixed livestock require labor to re sort livestock and missing livestock that is not found is a complete loss.

Large numbers of Elk in the pasture more frequent mean less grass and forage for grazing livestock. In fall months, August through October, grazing cattle require a certain amount of forage to stay healthy to survive the winter months which are our most common calving months. When elk deplete forage hay is required to purchase and feed cattle for loss of pasture. This results in a loss in electricity cost for irrigation and increased hay costs.

In Easter lily bulb production, a herd of Roosevelt elk trampling bulbs resulting in broken and damaged bulbs that were destined for market. Fall is harvest season for bulbs, and fall is mating season for elk. The elk migrate down to the valley where bulb production occurs seeking green grasses. Each bulb brings $0.70 - $1.10 per bulb.

As I write this letter, there are 50-75 elk in a 45 acre field that I have 30 angus beef steers in. This fall, I have re built the fence 3 times, have continued irrigation to keep grass green, am supplementing hay for my cows, and am missing 5 head due to the broken fences by the elk. This has been documented by CA fish and wildlife with a formal incident on 9/26/2018 at 6:44 a.m.

Though the few northwest hunts and share hunts that are offered have resulted in a some elk numbers being harvested, it does not come close to helping manage the current population, whatever that may be.

Please help landowners who depend on California agriculture for their lively hood become better protected from the on going losses due to Roosevelt elk. If I can be of any more help, please let me know.

Thank you.

Matt Westbrook, Owner

DAHLSTROM & WATT BULB FARMS, INC.
P.O. BOX 120 • SMITH RIVER, CALIFORNIA 95567 U.S.A.
PHONE: (707) 487-3961 FAX: (707) 487-1515
"^wmu fot a ^lowlnc] Q/VotCd."

October 4, 2018

Ca Dept. Fish and Wildlife

Re: Del Norte Elk

Please increase the Elk tag numbers in Del Norte County..... I am Rob Miller owner of Dahlstrom & Watt Bulb Farm in Smith River. I have lived in Smith River since 1966. The population of elk has grown from 0 to HUNDREDSAND HUNDREDS!!!!! The animals are crossing the highways here and are a public safety hazard. I have had the pleasure with my family in the car of having one run in front of my car and hitting it!!! They are a severe problem in the fields and cause many dollars of damage in MY LILY FIELDS. We have spent many dollars trying to fence them away. They are breaking thru electrified 6 foot woven wire fences!III They need to be MANAGED. The population has exploded because you are not managing them. PLEASE increase the tag count and make some attempt to control their numbers. It isjinfortunate that there is no good habitat on public property and you arexrelying ojyus to feed them. PLEASE HELP.

Rob Miller
President

''Reservation''Ranch

October 2. 2018

Ann Hilson
CA Dept. Fish and Wildlife

Re: Elk Damage

Ann:

We are a 1400 acre dairy farm that annually leases property to an Easter Lily bulb grower. For the past 20+ years we have sustained continual elk damage that every year increases considerably. The elk damage to fencing and crops continues to be an ongoing problem. We work year round to repair the constant elk damage to fences. Elk going through wire creates problems with keeping cattle contained. When any part of an electric fence is shorted out. the entire fence is dead. This is a big problem and creates liability when cattle get out on the roadway.

Elk damage to crops is also continual. When a herd of elk walk, run or stay for any time in a field planted with Easter Lilies, the lilies are permanently damaged. The weight of the elk on the soft dirt pushes the bulb so far into the ground that it causes the bulb to rot. When elk walk or run on pasture fields that are newly planted in the fall the area(s) where they have been do not grow into a full robust crop. Elk continually feed on our pastureland that is intended for our cattle. The year-round pasture/grass grazing by one or two herds of elk has created a shortfall of harvestable feed for our cattle. This has caused financial hardship as we must either purchase feed for our cattle or raise fewer animals because we are feeding the Slate's elk.

Should you have any questions or require additional information please contact me at 707-218-7522. Thank you.

Steven Westbrook
Manager

TIMBER • FARMING • LAND DEVELOPMENT ■ AVIATION

P O BOX 75 • SMITH RIVER. CALIFORNIA 95567 ■ OFFICE PHONE (707) 487-3516 • FAX PHONE (707) 487-1131
PO BOX 248 ! HIGHWAY 42 COQUILLE. OR 97423 • OFFICE PHONE (541) 396-2195 • FAX PHONE (5411 396-5661

Published Aug. 17, 2017 at 06:00AM

Pumpkin patch being ruined by wayward elk



A Fort Dick couple is facing a lot of frustration with herds of bull elk, forcing them to take shifts guarding their perennial crop from being destroyed by elk.

Larry and Diane Brock own and sustain a pumpkin patch in Fort Dick that is well-known by area children. Every year in October, the Brocks open their five acre property to all, especially kids, to explore and pick the perfect pumpkin. Diane said the farm has hosted about 2^000 kids in a year. Larry is also working to plant a cornfield on the property to open a corn maze for the kids by October.

Despite taking the recommended action of building elk deterrent fencing, fhe.heavy animals have repeatedly forced their way into the patch, destroying many plants at a time.

Elk have jumped through a nine-foot barrier of barbed and woven wire fencing. The giant hole now allows elk to jump through and wander around in the patch.

"Someone has to be out here almost all day long," she said, noting that small groups have since come around. She said the elk return every couple weeks and since the patch appears to be in their regular path, they will break down any fence in their way.

Diane explained that currently, the pumpkins, which are just starting to take shape, are planted under insulative plastic in rows with irrigating tubing running throughout. When elk walk over the insulative covering, they also break the irrigation lines. Sometimes, it's only when they notice withering plants that they realize a line has been broke, prompting them to find and splice the leak, she said. The insulated covering was dotted with holes caused by the elks' hooves over several acres.

"By poking holes in it, it lets the heat out," she said, noting that it causes further damage to the young pumpkins.

The Brocks spent about $3,000 on the fence and the costs keep adding up, along with the loss of revenue caused by destroyed plants.

"Each plant, depending on the variety, is worth $25 to $100," she said. "It depends on how many pumpkins are on there."

At 75 years old each, Diane and Larry say they are getting too old to keep up with the work of maintaining the farm while also dealing with the elk problem.

While she also appreciates the animals' beauty, Diane said people need to know that they can also be very destructive and have little fear of people. She said other area farmers also have problems with the elk, which seemed to be more common in lower areas than in years' passed.

"We had 62 head of elk down here a couple weeks ago/' she said, adding that larger herds have been recorded locally.

California Fish and Wildlife Warden Dave Lancaster said while elk do damage to other agriculture, such as grazing areas, it doesn't have the same impact as it does to the Brock's small, concentrated area crop.

Lancaster said the three main deterrents to elk are fencing, dogs and the use of rubber beanbag shotgun rounds.

However, the Brock's fencing has already been damaged and their only dog is a chihuahua. At age 75, it's hard to imagine Diane wielding a 12-gauge shotgun.

Lancaster said the remaining options involve either killing elk or essentially retraining them to go to areas where they do less damage.

Diane had a similar idea to attempt to herd the animals to an area near Lake Earl where she felt they would have adequate food and no human contact.

As for the other option, Lancaster said the department has a program that allows hunters to enter private property to kill and harvest the elk. He said property owners can charge a fee for that permission. Fees obtained through the program also go to the property owner, he said;

Depredation permits can also be obtained when an elk causes continued, significant damage to property or livestock. He said it's not a program the department encourages. He said the sport hunting option is better as it helps recoup costs for the property owner and helps control local populations.

In the meantime, the Brocks are still struggling to keep the elk out so they have enough pumpkins to host this year's' pumpkin patch. Diane said any help from the community is appreciated, from help with repairs to suggestions for keeping the elk out.

Reach Tony Reed at treed@triplicate.com (http://treed@triplicate.com</em)

#

Subject: ELK Hunting

From: Del norte Red (delnortercd@yahoo.com)

To: fgc@fgc.ca.gov;

Date: Wednesday, February 3, 2016 2:11 PM

February 3, 2016

RE: Elk Hunting - Del Norte County

The Del Norte Resource Conservation District would like to thank the commission for the opportunity to comment on the proposed changes to Section 364.

The Del Norte Resource Conservation District supports the purposed amended changes to Title 14, Section 364, Boundaries and Allocations (a) Department Administered General Methods Roosevelt Elk Hunt Areas. (2) Del Norte General Methods Roosevelt Elk Hunt, Special Conditions and Proposed Tag Allocations (r) (2) (A) (B) (C) (D) and (E).

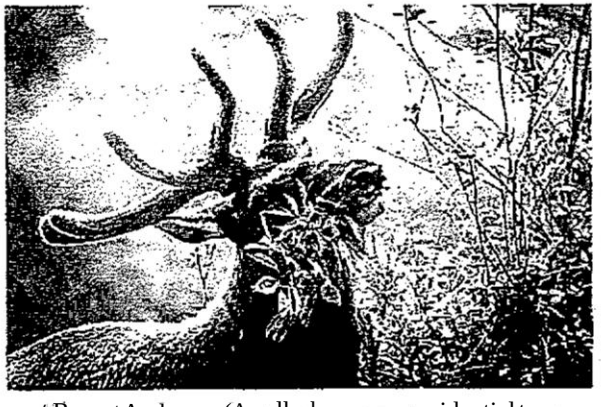
Property owners in Del Norte County continue to have destruction of Commercial lily fields, nurseries, orchards, fencing, livestock and horse damage and more. The herds have multiplied and not only is destruction of property still occurring but safety on our roads and residential areas is of great concern.

The boundary, tag allocations and season changes are appreciated. We have been working with Fish and Game for years to move towards a solution to the increased elk herds in Del Norte County. We look forward to a manageable elk program.

Dei Norte Resource Conservation District
Matt Westbrook, President

Published June 30, 2015 at 01:03PM / Updated February 13, 2016 at 06:24PM

County seeks role in elk policy



/ Bryant Anderson (An elk chews on a residential tree in the Bertsch Tract. DeTNorte Triplicate)
Buy photo

Local residents and elected officials spoke up at Tuesday's Del Norte County Board of Supervisors meeting to say they want to be involved before the important decisions are made on a plan being developed to manage a burgeoning elk population.

By consensus it was decided that the supervisors will send a letter to the California Department of Fish and Wildlife formally requesting a copy of the agency's latest draft of an elk management policy, with local complaints of elk¬ damaged property being on the rise for several years now. A statewide strategy was elicited by Fish and Game Commission legislation passed in 2003.

The last letter the county penned on a similar resource management issue, pitting local government against state-level policymakers, was too late to reverse the California Fish and Game Commission's decision to close the mouth of Blue Creek to fishing.

County Supervisors hope to get a hold of the draft management plan, which so far eludes them, in order to make some suggestions before it goes out to the public for review, scheduled to occur this summer or fall.

Speaking to Eric Loft, chief of the wildlife branch of California Department of Fish and Wildlife, and Joe Hobbs, CDFW elk and antelope senior scientist, who attended Tuesday's meeting to discuss the ''chronic elk problem" (Loft's words), District 5 Supervisor David Finigan again cited the Fish and Game Commission's Miscellaneous Policy "to coordinate closely with local agencies, including the county boards of supervisors, in the formulation and implementation of any new plans," a driving point of the Blue Creek letter. The commission establishes regulations and CDFW enacts them - any new regulations that come out of a general management plan developed by CDFW will have to go before the commission.

District 2 Supervisor Martha McClure wondered how the state was going to "write a document about what elk should do in California" without consulting people who have intimate knowledge of how many there are, how they behave now or how they behaved historically.

Tm uncomfortable because I'm afraid you're asking the county to, 'Do us a favor and sit on the side over here while we take care of this business of coming up with an elk plan, while we come up with this business of how many elk tags are going to be in your community, while we come up with an environmental analysis,' when you're sitting on the

people who have the information. I see all these folks out here I know ... could probably tell me how many elk there are in the county, and it would probably be within 20," McClure said.

Hobbs said that he'd be happy to sit down with the supervisors to go over what goes into an environmental analysis - a document that determines how many elk tags are allotted per year. These documents have traditionally been updated every two years, but Hobbs said the current one, granting 54 tags on the North Coast (out of 350 statewide), hadn't been updated since 2010, but he said he's working on adjusting the tag quota. "Obviously there are more elk now than there were in 2010," Hobbs said.

An updated environmental document draft should be up for public review in September, to be formally adopted in April of next year.

If the number of permitted kills is upped in the coming document, the department will still "err on the side of caution," he said. "We don't want to take (elk numbers) down to below viable."

With limited survey data on the North Coast, Hobbs reported the department had estimated 1,600 elk reside locally, a number he acknowledges likely undershoots the truth. With a "vast amount of canopy closure and steep terrain," Hobbs wrote in an email to the Triplicate, it's difficult to get accurate numbers on the coast.

Two new elk specialist positions are in the process of being approved for Region 1 (which includes Del Norte, Humboldt, Modoc and Lassen counties and everything inbetween), one of which will be assigned to the coast. Hobbs said this will be a huge boon to his department in addressing how many elk there are on the coast, how much ground they're covering and which lands they frequent - which should result in better informed policies. One of the most effective long term strategies for controlling populations, he wrote, is through regulated hunting.

Costly to keep out

"Here I am in a city district, besieged by no shortage of people who are very concerned about how this is impacting their life," District 1 Supervisor Roger Gitlin said. "We don't know the population of elk - I've heard estimates from 1,600, which you're mentioning now to upwards of 2,500 - but we do know the populations of the problems caused by elk."

There was no shortage of county residents at the meeting, either, particularly those hailing from the Bertsch Tract, airing their amassing concerns about public safety and damaged property.

Terri McCune-Oostra said she and her husband had to close down their nursery, the Dutch Gardener, months early last year because elk were stomping through display gardens and ripping through plastic greenhouses.

Several people noted that the fence required to keep elk off their property was far too expensive.

Helen Ferguson spoke on behalf of her aging uncle, whose 12-foot fence doesn't suffice for sheltering his fruit trees. A 94-year-old man shouldn't be expected to carry a gun with him when he goes out his back door, she said.

Others suggested that better management of public lands would provide more feeding habitat and thereby get elk off private land. Corridors were suggested to help the elk move between locales while staying off the roadways.

Don Steinruck, Native American Graves Protection and Repatriation Act specialist for the Tolowa Dee-ni' Nation (formerly the Smith River Rancheria), cited the United Nation's declaration of indigenous people's rights, which includes autonomous use and access to traditional foods. The tribe, he said, requests 10 elk for its own traditional use

each year.

In addition to the 54 hunting tags already issued on the North Coast, nine private land management tags for depredation will be issued, Hobbs reported. Permits have been issued for property damage - to include fences - but not for elk grazing in pastures. Hobbs acknowledged that depredation permits are not a long term solution. Public lands often don't compete with private "bottom lands" which have the better soil, he wrote in an email to the Triplicate. "Elk are going to use the best stuff around, they know what is good and more nutritious to eat," he wrote. "The Department is very willing to work with all those involved to come up with management actions that could help with the elk situation."

Reach Laura Jo Welter at lwelter@triplicate.com .

DEL NORTE

RESOURCE

conservation oistriot

September 24, 2015

Joe Hobbs
California Department of Fish and Wildlife
Elk and Antelope Coordinator
1312 9th Street
Sacramento, CA 95311

Dear Joe Hobbs,

The Del Norte Resource Conservation District thanks you for the opportunity to input on the framework of changes for elk hunting in Del Norte,

The Del Norte Resource Conservation supports the General Hunt and Shared Habitat Alliance for Recreational Enhancement (SHARE). Suggestions at our last RCD meeting with many Del Norte private landowners were to give Del Norte its own boundaries. Many De! Norte private landowners are willing to enter into the SHARE program with the goals of a program in place to reduce elk population in Del Norte County and at the same time, meet your mission statement, "manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public".

The group would like to see hunts ranging from September (General) October through January (SHARE) in Del Norte County to include increased cow tags with bulls to encourage participating hunters. We have concerns on the liability protection program offered by CA. Fish and Wildlife but through a collaboration effort we are working towards a solution.

Thanks for your help in working towards a manageable elk program for Del Norte. This is essential in moving forward towards addressing public concerns on safety, damage to livestock and property, and herd populations.

Sincerely,

Linda Crockett-Manager
The Del Norte Resource Conservation
241 IrtStreet
Smith River, CA 95567
707 4377630

June 24, 2015

Lake Earl Grange #577
Environmental Policy and Procedure Committee

Mr. Lancaster

The Lake Earl Grange asks you to attend a meeting June 29, 2015 from 6-3pm at the Lake Earl Grange Hall. It would be an "Elk Workshop". Our Lake Earl Grange Environmental Policy and Procedure Committee Will be conducting the meeting with direction towards options available under California Fish and Wildlife to address damages caused by Roosevelt Elk in Del Norte County. It is the intent of our Committee to invite our County BOS , a representative from the bulb, dairy and beef industries ,a private citizen representing residential concerns, the Del Norte County Farm Bureau President, representation from our Resource Conservation District as well as representatives from our local Native American groups. We would consider this workshop to be a fact finding event as well as a question and answer session. At the end of the session we would welcome the opportunity to discuss our local ideas regarding "Elk Solutions" by those representatives in attendance.

Please let us know if you could be in attendance.

Sincerely,

Helen Ferguson
Chair Lake Earl Grange
Environmental Policy and Procedure Committee
707-213-5769

Linda. Please tell Joe the boundary for the NW hunt and the share tag allocation should be separated into JUST Del Norte county. The number of Del Norte tags needs to be greatly ^increased with cow tags preferred and of course some bulls. The local hunters should be given some priority hopefully. The number of total tags MUST be increased greatly in this county.
Rob Miller. President DNCo Farm Bureau...

Sent again FG Commission on 11/24 Email

Tues.

'"7 6:30
Lin ^gg^ckett

'^^From: Steven <reservationranchsteven@gmail.com>
Sent: Thursday, March 06, 2014 9:02 AM
To: Lancaster, David©Wildlife; crockett; blake@ecodairyfarms.com; chris@ecodairyfarms.com; pwincranches@yahdo.com
Subject: Re: Updatde Regarding Elk Hunt Proposal

D^ye:

Thanks for the update on the elk hunts. I am obviously disappointed that the Department was not able to allow the hunt in the Bottoms. I am extremely unhappy that the Department (based on your email) does not see the problem as being one of extreme significance to the iandowners/farmers of Del Norte and Humboldt counties. This strikes me as being very similar to the Aleutian Goose issue where the expectation is that the landowners/farmers will feed the geese (elk) until there is more extreme pressure put on the Department to do something (i.e. revise the environmental document) that allows more take of the species.

I personally find the increasing number of elk a real threat to the public that drives along US Highway 1Q1 every day. This threat along with the damage they cause to our property and crops should be enough to show the Department that action on their part is over due and expected. We all know that this increase in the tag number is in no way keeping pace with the rate of reproduction of these animals.

What can we do to convince the Department that they need to find it in their budget to revise the Elk Environmental Document so that we can work together to limit continuing property and crop damage and stabilize the number of these animals?

^^Steven Westbrook
Reservation Ranch

— Original Message —
From: Lancaster, David@Wildlife
To: crockeit@uiiitedNy.Qorn ; blake@e»7adair yrai ihs coni ; dirisfflecodaimanna.com ; reswvaliyni anchstuvsn@.amail go<u ; pwinufanches@vanqo.coiT,
Sent: Tuesday, March 04, 2014 10:37 AM
Subject: Updatde Regarding Elk Hunt Proposal

Hi,

The elk hunting proposal we discussed to add three hunt periods to the Northwestern California Elk Hunt specific to the Smith River Bottoms was forwarded by the Northern Region to the Wildlife Programs Branch in Sacramento for evaluation. The Wildlife Programs Branch reviewed the proposal but was unable to forward it to the Fish and Game Commission to be considered for the 2014 hunting season. Staff at the Wildlife programs Branch cjted the following reasons:

1) Subdividing the Northwestern California Elk Hunt Zone through the creation of hunt periods specific to the Smith River Bottoms is not allowed under the existing Elk Environmental Document. The Department hopes to revise the Elk Environmental Document in the next couple of years depending on the availability of staff.

2) The Department has determined that a Statewide Elk Management Plan must be completed prior to considering major elk hunting regulation change proposals. A draft of this document is currently under review.

In light of this and increasing depredation complaints on the North Coast, including Humboldt County, the Department has developed the following proposal:

To whom it may concern:

I appreciate the opportunity to review the "Draft Supplemental Environmental Document", Elk Hunting (DSED), dated Feb. 14, 2019. It is unfortunate that the same ignorance that existed in the original "elk management plan" is perpetuated by the DFW/FGC in this aforementioned "Draft Supplemental Environmental Document" (DSED). See below:

1) "ELK POP". Four years ago I wrote to Joe Hobbs (DFW) and questioned the DFW's use of a 1987 computer model by Smith and Updike (pg. 21). This computer model program is valid for only "2-10 (at the maximum) years". Today, over 30 YEARS LATER, the DFW/FGC continue to generate "fake news" based upon these "fake figures". I think this is appalling and is NOT acceptable. In my opinion, all the "computer model runs" have no credibility, along with the rest of the DSED. Given the above, it appears to me that the DFW/FGC cannot make any legitimate claims about the population of the Roosevelt or set any responsible hunting quotas using this obsolete "computer model". This is the 21st Century, in case the DFW/FGC are not aware of the progress in technology.

I think the DFW/FGC will have much to learn if they would read the reports on the Roosevelt elk researched by the Redwood National and State Parks (RNSP). The RNSP conduct authentic research that is professional.

2) POPULATION OF THE ROOSEVELT ELK IN THE NORTHWEST ZONE. Given the above (#1), the "fake news" and the "fake figures" (based on a computer model that is over 30 years beyond its suggested use), it is obvious to me why I consider the DFW/FGC's DSED fallacious. The DFW/FGC report that there are 1,600 Roosevelt elk (pg. 22), this may be nothing more than a concocted number with no validity.

Again, I refer the DFW/FGC to read the relevant research done by the RNSP.

3)CULLING OF ROOSEVELT ELK BULLS. The DFW/FGC recommends maintaining a ratio of 25 bulls for every 100 cows (pg. 24). The scientific community considers this to be a minimum ratio of bulls for every 100 cows. BUT, the DFW/FGC contradicts their own recommendations and reduces the number of bulls (for 100 cows) to 15 in the Northwest zone!!! The DFW/FGC provides no scientific research behind their decision. I have spoken to reputable biologists who state that a ratio of 15 bulls for every 100 cows is NOT SUSTAINABLE!!! Please provide an explanation to myself and the public for your digression.

Please note, the DFW/FGC does not appear to value the "mature" bulls for their survivorship. Rather than protect the older bulls, with the largest racks, the DFW/FGC condescend to the "trophy hunters". I believe this is contrary to Darwin's theory of natural selection and is another example of poor stewardship by the DFW/FGC.

4) CALF MORTALITY. The DFW/FGC claim that calf mortality is "low" (pg. 19). This is NOT agreed upon by reputable biologists. Their research indicates that Roosevelt elk mortality rates are "high". Refer again to the above (#1).

5) PROJECTIONS. The DFW/FGC present SPECULATION in this DSED (pg. 6) in the form of "alternatives". The DFW/FGC select arbitrary numbers of increases by 10, 20 or 60 tags. It sounds to me that the DFW/FGC are treating the management of the Roosevelt elk as nothing more than a crapshoot. I believe that the hunting allowance is NOT determined by "fake news" and "fake figures", but done by scientifically documented research about what is good stewardship for the herds.

6) PLM AND SHARE HUNTS The additional Roosevelt elk, in particular, the mature bulls, killed in the PLM and SHARE programs indicate a tendency for the killing of bulls to be increasing. These programs are very deceiving since the Roosevelt elk killed are reported on separate tables. I would like more transparency within the DFW/FGC by incorporating the PLM and SHARE hunts on the same tables with the general hunt.

Please explain why, in 2018, there were 15 tags issued to kill bulls, BUT 18 were killed (pg. 18)? Please explain.

7) "THE COMMITTEE" The DFW/FGC does not address the composition of "the committee" in the DSED. As I recall, DFW/FGC gave 2 positions to the Rocky Mountain Elk Foundation and no positions were assigned to any conservation groups. I think this is not fair and is biased. I would like one of the Rocky Mountain Elk Foundation's seats to be assigned to a conservation group.

8) BIBLIOGRAPHY Four years ago I wrote to Joe Hobbs (DFW) and shared with him my observation that the bibliography for the "Draft Environmental Document", dated Dec. 8, 2015 was lacking current scientific research and was very obsolete. In comparison, the DSED (dated Feb. 14, 2019) continues to present the same deficiencies and a lack for current research. In particular, there is an obvious omission of the reputable research done by the RNSP. I insist that this change as the RNSP has so much to offer to DFW/FGC about their research done on the Roosevelt elk.

The Supporters for Del Norte Roosevelt Elk have been working with the DFW/FGC for over 4 years on behalf of the Roosevelt elk in Del Norte County. I have provided both agencies with relevant suggestions based on scientists' research pertaining to the good stewardship of the Roosevelt elk. Hundreds of thousands of Roosevelt elk were slaughtered by hunters to near extinction around 100 years ago. I am insulted by the DFW/FGC's DSED and suggest that it be re-done without the "fake news" and "fake figures".

Sincerely,

Phoebe Lenhart

Supporters for Del Norte Roosevelt Elk

elaphusandfelis2@gmail.com



Keeping Northwest California wild since 1977

Sent via email on date shown below

April 4, 2019

Valerie Termini, Executive Director
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090
fgc@fgc.ca.gov

Director Charles Bonham
Wildlife Branch Chief Kari Lewis
California Department of Fish and Wildlife
1416 9th Street
Sacramento, CA 95814
Kari.Lewis@wildlife.ca.gov
chuck.bonham@wildlife.ca.gov
Victoria.Barr@wildlife.ca.gov
Joe.Hobbs@wildlife.ca.gov

Dear Commissioners, Director Bonham, and Chief Lewis,

On behalf of the Environmental Protection Information Center and the Friends of Del Norte (collectively "EPIC"), please accept these comments on the Draft Supplement Environmental Document for the North Coast Elk Management Unit ("SEIR"). After carefully reviewing the document and tiered associated documents, EPIC believes that the SEIR fails to take a hard look at the environmental consequences of increasing elk tags, and as such, the Commission should reject proposed changes to hunting tags and the Department should return to the Commission with a revised SEIR that adequately considers points raised in this letter.

SEIR Fails to Examine Reasonable Range of Alternatives

The SEIR fails to analyze a reasonable range of alternatives by only considering maintaining the current level of hunting or increasing the total amount of hunting. In this manner, the SEIR is lacking and needs to be amended to consider a true range of alternatives—including alternatives that *reduce* the total amount of elk tags offered.

"CEQA requires that an EIR, in addition to analyzing the environmental effects of a proposed project, also consider and analyze project alternatives that would reduce adverse environmental impacts." *In re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings*, 43 Cal.4th 1143, 1163 (2008); *see also* Guidelines, § 15126.6, subd. (a).) "An EIR need not consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decisionmaking and public participation. An EIR is not required to consider alternatives which are infeasible. The lead agency is responsible for selecting a range of project alternatives for examination and must publicly disclose its reasoning for selecting those alternatives. There is no ironclad rule governing the nature or scope of the alternatives to be discussed other than the rule of reason.'" *Watsonville Pilots Assn. v. City of Watsonville,*183 Cal.App.4th 1059, 1086 (2010) (internal citation omitted.) In evaluating whether a decisionmaking is capable of making an informed decision, courts will often examine whether the alternatives presented "represent enough of a variation to allow informed decisionmaking." *Mann v. Cmty. Redevelopment Agency*, 233 Cal.App.3d 1143, 1151 (1991).

The Supplemental EIR fails to present a reasonable range of alternative by only examining whether alternatives that *increase* elk hunting, either by a little or a lot. Unconsidered by the SEIR is whether elk hunting should *decrease*—a reasonable suggestion, given changes to forage from global climate change, recovering gray wolf populations in the state, and the obligations of the Department and Commission.

The Department makes no explanation of why it did not consider a reduction in elk hunting. Presumably, the reason is similar to why the Department rejected Alternative 3, which would increase hunting tags by 10 tags: the alternative would "not optimize public hunting opportunities or alleviation of conflicts on private property." The Commission, however, has no obligation to issue the maximum number of hunting tags or to "optimize" hunting opportunities. As the Department admits, the Legislature has given the Commission substantial power to consider a wide range of considerations, including "populations, habitat, food supplies, the welfare of individual animals, and other pertinent facts," when setting tag numbers. The Commission *must* consider non-hunting recreational opportunities associated with elk and balance consumptive versus non-consumptive uses.

The Supplemental EIR examines four potential alternatives, including the "No Project" alternative. The Proposed Project would "[i]ncrease the tag quota range for the Northwestern Elk Zone by 20 tags," SEIR at 6, for a total of 108 elk tags issued. *Id*. at 19. Alternative 1, or the "No Project" alternative, would result in "[n]o change from the 2018-19 hunting regulations," *id.*, or stated another way, Alternative 1 would authorize the issuance of 88 elk tags. Alternative 2 would "[i]ncrease the tag quota range for the Northwestern Elk Zone by up to 60 tags." *Id.*. Alternative 3 would also increase the number of elk tags issued by 10 tags. *Id*. In short, all the action alternatives analyzed only consider additional hunting.

In this manner, the alternatives analysis is comparable to the seminal case *California v. Block,* 690 F.2d 753 (9th Cir. 1982), which examined alternatives analysis under the substantially similar National Environmental Policy Act. In *Block*, the Forest Service was tasked with considering future potential additional Wilderness Areas. In doing so, the Forest Service

analyzed eleven alternatives—which is, by NEPA and CEQA standards, a large number of alternatives—but the Forest Service never examined any alternative that designated more than 33 percent of inventoried roadless areas to Wilderness. The Ninth Circuit found that the Forest Service's analysis failed to provide a reasonable range of alternatives. As the court found important, the Forest Service was forced to weigh competing values—more wilderness or less—but in drawing a line at 33% and by not considering alternatives that considered *additional* acres of Wilderness, the Forest Service failed to examine information necessary to form a "reasoned choice." This "trade off," the court reasoned, "cannot be intelligently made without examining whether it can be softened or eliminated by increasing resource extraction and use from already developed areas." Further, the court noted that "[w]hile nothing in NEPA prohibits the Forest Service" from adopting an alternative that added less Wilderness and not more, it was nevertheless "troubling that the Forest Service saw fit to consider from the outset only those alternatives leading to that end result."

Here, the Commission cannot make a "reasoned choice" because it was only given alternatives that examined additional hunting. It never considered how less hunting impacts herd populations, non-lethal recreational opportunities, animal welfare, or the myriad of other things that the Commission is charged with considering. In the same manner, the Department's analysis appears to predetermine a set outcome—more hunting—instead of grappling the hard trade offs that must be made.

Hunting Places Reproductively Stressful Pressures on Populations when Paired with Predation

Hunting, together with predation, can affect herd population dynamics. Wolves have returned to California, although not to the Northwest EMU yet. That said, it is a matter of time before wolves return to the area. For example, the first wolf in approximately 100 years traveled through Del Norte County in 2019.

Wright et al. 2006 show that in a survey of antlerless elk, a large majority of the elk taken were considered to be at a "reproductively prime age." That is, between the ages of 2-9 years. Wright then goes on to show that in the study, the combined influence of hunters taking out median ages, and predators taking out individuals at either extreme, herd numbers and viability began to decline. Please consider Wright, G. J., Peterson, R. O., Smith, D. W., & Lemke, T. O. (2006). Selection of Northern Yellowstone Elk by Gray Wolves and Hunters. Journal of Wildlife Management, 70(4), 1070-1078 in your final Supplemental EIR.

As reported by Hebblewhite (2005), wolf presence together with inclement weather (associated with a changing climate) produced more dramatic decreases in elk population growth rate than just inclement weather alone. *See* Hebblewhite, M. 2005. Predation by wolves interacts with the North Pacific Oscillation (NPO) on a western North American elk population. Journal of Animal Ecology 74:226-233. Further, changing weather can increase wolf predation rates. EPIC and the Department admit uncertainty over how these stressors will impact elk populations in real life. But it is this uncertainty that counsels that more analysis, through a larger range of alternatives, is more necessary to inform decisionmaking.

The SEIR Fails to Appreciate Risk from Vehicle Strikes

The Supplement EIR's discussion on impacts from vehicle strikes is short and conclusory. It read, in total:

> The number of elk killed by vehicles is not well documented. Unlike deer, very few elk in California appear to be killed by automobiles each year. Vehicle-caused elk mortalities have been reported (specifically with Roosevelt elk in Del Norte and Humboldt counties and tule elk in the Owens Valley and at Cache Creek) since 1990. Unreported incidents cannot be quantified. However, the [Department] believes effects of vehicle-caused mortality on statewide and localized elk populations are minimal.

The Department does not appear to be aware that increased vehicle strikes, perhaps together with increased poaching, likely caused the extirpation of an important herd of Roosevelt Elk. The Boyes elk were first documented in Boyes Meadows in 1937. By the late 1940s, their population ballooned to around 100, taking advantage of the newfound forage to jump in size. Over time the population settled; between 1950 to the late 1990s, the population fluctuated between 20-60 individuals. In 1998, there were 30 elk. By 2011, the herd was extirpated.

In 1984, Caltrans began planning for a bypass around the old-growth of the park—today, we call the original road the "Newton B. Drury Bypass." This "improvement" came at a cost. The new road opened in 1992. Construction of the road created meadows and clearings, which were soon utilized by elk. Increased road kill soon followed. In places, the road is quite steep. Cars heading downhill (southbound) may find it difficult to stop or evade elk in the roadway. Similarly, elk may find avoiding humans more difficult. In 2003, Caltrans installed a barrier to separate north and southbound lanes. The barrier, intended to keep cars from cross lanes, was also likely effective in limiting elk mobility, making attempts by elk to evade or avoid vehicles more difficult. Elk and other ungulates have a difficulty assessing vehicle speeds and distance, perhaps making last minute maneuvers, and things that inhibit that flight response, more important. Furthermore, these elk were habituated to humans, and the elk may have had difficulty determining which vehicles detected them and wanted to slow to observe and which vehicles did not detect them or wanted to poach them.

Del Norte County provided records within their letter to the Department containing additional instances of elk strikes known to the county. Please consider these accounts and attempt a more meaningful investigation of potential impacts instead of relying on conclusory statements.

The Supplemental EIR Likely Downplays Impact of Poaching

The Supplemental EIR appears to downplay the real danger that poaching plays on local elk populations in finding that poaching will not have significant adverse cumulative effects. To support this conclusion, the Supplement looks to, among other things, citation data from 1997, 1998, 2000 and 2001.

Since 2017, there have been six reported cases of poaching in the Northwestern EMU, including one pregnant elk:

- https://lostcoastoutpost.com/2017/feb/8/dismembered-elk-found-redwood-national-park-ranger/
- https://lostcoastoutpost.com/2018/dec/14/four-roosevelt-elk-one-pregnant-killed-near-blue-l/
- https://lostcoastoutpost.com/2018/nov/1/elk-illegally-shot-death-arrows-north-orick-park-r/

It is strange that EPIC, through a simple Google search, is able to turn up more recent data than the Department.

EPIC agrees with the Department that "[i]llegal harvest of game mammals is difficult to quantify." As one article mentions, there had appeared to be an attempt to hide evidence of poaching. As most wildlife experts agree, most cases of poaching are not discovered and only one to five percent of poachers are caught. The Department, however, does not appear to be interested and dismisses poaching impacts by concluding, without evidence, that poaching is unlikely to have a significant cumulative effect.

The Supplemental EIR is Contingent on the "Elk Pop" Model, Yet the Model Appears Flawed and Lacks Indicia of Scientific Integrity

EPIC is concerned about the Department's reliance on the "Elk Pop" model, Smith, D. and D. Updike. 1987. Elk Pop, unpublished computer population simulation model. Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814. According to the Supplement, the model was produced by the Department and was released in 1987.

EPIC is concerned with the Department's reliance on a model completed by itself over three decades ago used to justify the Department's own decision. Additionally, there are other factors that call into question the reliability and integrity of the Elk Pop Model. Based on EPIC's review of multiple scientific databases, it appears that the Elk Pop model was: (1) never been peer reviewed; (2) never validated by on-the-ground counts, or if validated, the data been made available. Given these issues, it is not sound for the Department to be reliant on the Elk Pop model.

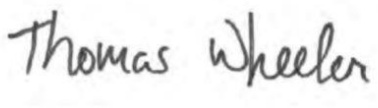
Model results published in the appendix to the Supplement shows the number of elk killed by "non-hunting causes." Presumably, this accounts for all other potential causes of mortality, such as vehicle strikes, poaching, starvation, predation, etc. The model assumes a rate of 23.5% of bulls lost to non-hunting causes and 11.9% of cows. It is not clear where these numbers come from. Again, a lack of validation concerns EPIC. Furthermore, we are concerned that the Department treats these numbers as static, despite a changing world. Assuming that the Department arrived at these mortality rates from observation in 1987, these represent a snapshot of conditions in that year. As the Supplement acknowledges, elk face a variety of population stressors, but that these stressors change from year to year, whether it is drought or poaching. Furthermore, as discussed above, climate change and new predators might increase the non-hunting mortality rate above historic levels.

Conclusion: The Commission Should Reject the Draft SEIR as Incomplete and Request Revision from the Department

Based on the concerns outlined above, EPIC requests that the Commission reject the Draft SEIR as incomplete and ask for revisions to ensure that the Commission can take a hard look at the likely environmental impacts of the proposed actions.

Should the Department or the Commission have questions regarding this letter, please do not hesitate to contact our organizations at tom@wildcalifornia.org or (707) 822-7711.

Sincerely,



Thomas Wheeler, Executive Director
Environmental Protection Information Center

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MICROSATELLITE ANALYSIS OF THREE SUBSPECIES OF ELK *(CERVUS ELAPHUS)* IN CALIFORNIA

E. P. Meredith, J. A. Rodzen.* J. D. Banks, R. Schaefer, H. B. Ernest, T. R. Famula, and B. P. May

California Department of Fish and Game. Wildlife Forensics Laboratory. 1701 Nimbus Road. Suite D. Rancho Cordova, CA 95670. USA IEPM. JAR. JDB. RS)
Wildlife and Ecology Unit. Veterinary Genetics Laboratory, University of California Davis. One Shields Avenue, Davis, CA 95616, USA (HBE)
Department of Animal Science. University of California Davis. One Shields Avenue. Davis. CA 95616. USA (EPM. TRF. BPM)

A total of 676 elk *(Cervus elaphus)* were genotyped at 16 tetranucleotide microsatellite loci to evaluate genetic differences among 3 subspecies of elk in California: tule *(C. e. nannodes).* Roosevelt *(C. e. roosevelti).* and Rocky Mountain (C. *e. nelsoni)* elk. Of the 13 populations analyzed, 5 represented tule elk herds, 3 were Roosevelt elk, 2 were Rocky Mountain elk, and 3 were of uncertain taxonomic status. Overall, populations averaged between 7 and 8 alleles per locus, with observed heterozygosity values ranging from 0.33 to 0.58 per population. Tule elk, which experienced a severe bottleneck in the 1870s, had consistently less genetic diversity than the other subspecies. All 3 subspecies were significantly differentiated, with the greatest genetic distance seen between the tule and Roosevelt subspecies. Assignment of individuals to subspecies using microsatellite data was nearly 100% accurate. Despite the past population bottleneck, significant differences were found among the tule elk herds. Assignment testing of elk from Modoc, Siskiyou, and Shasta counties to determine subspecific status of individuals suggested that these populations contained both Roosevelt and Rocky Mountain elk and their hybrids, indicating that these elk subspecies interbreed where subspecies coexist.

Key words: California, *Cervus elaphus*, elk, genetics, hybrid, microsatellite, population

Elk *(Cervus elaphus)* herds that roamed a large portion of North America have been reduced in both area and number due to hunting pressure and loss of habitat. Although management strategies have aimed to reintroduce elk to some of their original range, these programs are not without potential genetic consequence. Genetic bottlenecks and founder effects are of great concern, and exacerbated by harem mating structure and high variability in male reproductive success (Clutton-Brock 1989).

California contains 3 of the described subspecies of free-ranging elk: tule elk *(C. e. nannodes;* historic resident of oak woodlands and grasslands), Roosevelt elk *(C. e. roosevelti;* northwestern coastal area), and Rocky Mountain *(C. e. nelsoni;* occupying the extreme northeastern comer of California, including Modoc County) elk. The remaining extant subspecies, Manitoban elk *(C. e. manitobensis).* occurs east of the Rocky Mountains in the northern plains states and into central Canada but does not inhabit California. Although each subspecies naturally occurs in different locations within California, there are potential geographic regions of overlap between Roosevelt and Rocky Mountain elk, allowing for the possibility of hybrid zones.

Tule elk residing in the Central Valley and oak woodlands of the foothills of California were almost eliminated after the gold rush of 1849 (McCullough et al. 1996). Historically estimated at more than 500,000 animals, tule elk were compromised by extreme hunting pressure and conversion of grass and woodland habitat into farming and agricultural operations. In 1873, when tule elk were thought to be extinct, protection was granted by the state of California (McCullough 1969; McCullough et al. 1996). Although exact numbers vary, it is believed that at least a single breeding pair of tule elk was found and protected in the southern San Joaquin Valley in Kern County. California, in 1874. Those remaining elk are believed to be the ancestors of extant tule elk populations in California (McCullough 1969; McCullough et al. 1996).

Roosevelt elk inhabit their historical range in the northwestern coastal mountain ranges of California (O'Gara 2002), mainly Humboldt and Del Norte counties. Only elk inhabiting these 2 counties are categorized as Roosevelt elk by the Boone

* *Correspondent: jrodzentp.dfg.ca.gov*

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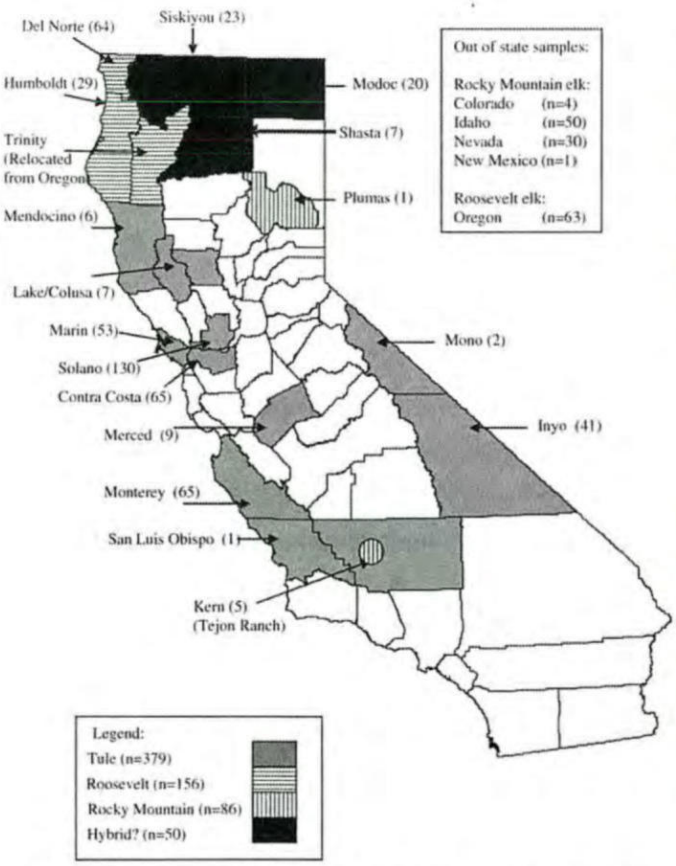


Fig. 1.—Map depicting number of individuals sampled at each herd location given by county name. Gray shaded areas represent counties that contain herds of tule elk, horizontal lines indicate counties with herds of Roosevelt elk, vertical lines indicate counties with herds of supposed Rocky Mountain elk, and diagonal lines indicate potential hybrid zones of Roosevelt and Rocky Mountain elk.

and Crockett Club (Missoula, Montana) for trophy-hunting purposes (Reneau and Reneau 1993). Discrimination of distinct herds of Roosevelt elk is difficult because of the dense forest habitat. Examination of satellite tracking data indicates restricted movement of animals and the possibility of distinct herds (R. Schaefer, in litt.).

Examination of satellite data (R. Schaefer, in litt.) provides evidence that Rocky Mountain Elk of northeastern California may migrate between Modoc County and Oregon. Idaho, and Nevada. Circa 1913, approximately 50 Rocky Mountain elk from Montana were introduced into Shasta County, California (R. Schaefer, in lilt.).

Shasta, Siskiyou, and Modoc counties in northern California are considered to be potential hybrid zones for Roosevelt and Rocky Mountain elk by California Department of Fish and Game wildlife managers. For the purpose of our study, the term "hybrid" refers to an intraspecific cross. Interstate 5. a major north-south highway in Washington, Oregon, and California, has been used as an arbitrary management boundary for subspecies delineation: elk occurring west of interstate 5 have been designated Roosevelt and those to the east of Interstate 5 as Rocky Mountain elk. Lone elk are known to wander and travel great distances (>150 miles—R. Schaefer, in litt.). and crossing the unfenced Interstate 5 is likely, as inferred by presence of road-killed elk (R. Schaefer, in litt.). Because Roosevelt and Rocky Mountain trophy elk are recorded separately by hunting organizations, determination of the genetic lineage of animals in these areas will benefit trophy hunters and wildlife managers.

Subspecilic status of North American elk has been hotly debated (see O'Gara |2002] for discussion of the taxonomy of North American elk). Overlap of morphological differences among tule, Roosevelt, and Rocky Mountain subspecies demands that other discriminating criteria, such as molecular genetic analyses, are used to address taxonomic status. Tule elk are considered the smallest subspecies of North American elk (Merriam 1905) and are typified by having lower body masses, lighter pelage, and the longest toothrows of any North American subspecies. Roosevelt elk reportedly have the largest body mass and display different antler and jaw morphologies from the others (McCullough 1969; O'Gara 2002). Of the 3 subspecies, Rocky Mountain elk typically have the largest antlers (Reneau and Reneau 1993).

Evidence derived from mitochondrial DNA indicates that tule elk are more closely related to Rocky Mountain than Roosevelt elk. and supports the subspecific status of these 3 categories of elk (Polziehn et al. 1998, 2000; Polziehn and Strobeck 1998, 2002). Using microsatellite data. Williams et al. (2004) showed that tule elk display reduced genetic variation relative to Rocky Mountain and Manitoban elk; however, small sample size prevented robust tests of genetic differentiation among populations of tule elk.

The primary goal of our study was to measure the degree of nuclear genetic differentiation between tule, Roosevelt, and Rocky Mountain elk and evaluate whether the populations of elk in California warrant status as evolutionarily significant units. Given that Roosevelt and Rocky Mountain elk are sympatric in California, yet recorded separately for trophy records, wildlife managers will benefit from genetic information that identifies subspecies composition, particularly in potential hybrid zones. Genetic discriminators will allow identification of subspecies in trophy animals, hair samples from field sampling efforts, and forensic samples. Toward these objectives, we used 2 population assignment programs, WHTCHRUN (Banks and Eichert 2000) and STRUCTURE 2.1 (Pritchard et al. 2000), to test the accuracy of assignment to subspecies from multilocus genotype data. Lastly, we assessed the risks and degree of inbreeding faced by herds of tule elk and make recommendations for monitoring and managing these herds.

Materials and Methods

Sample collection and DNA isolation.—A total of 676 elk were analyzed in this study (Fig. 1). The majority of the samples were from a large tissue archive maintained by the California Department of Fish and Game's Wildlife Forensic Laboratory (Rancho Cordova. California). Tissue and blood samples were collected from road-killed animals or animals legally taken at scheduled hunts and elk relocations throughout

California from 1997 through 2003. Samples were shipped frozen on ice to the Wildlife Forensic Laboratory and maintained at −20°C until DNA extraction.

Tule elk from 8 herds were sampled, including 2 of the original 3 surviving herds established in the 1930s: the Owens Valley herd (Inyo County) and the Cache Creek herd (Colusa and Lake counties). The remaining 6 herds of tule elk sampled were created by later translocations; however, all herds of tule elk are descendants from 1 original remnant population.

Samples of Rocky Mountain elk collected from Nevada and Idaho served as reference samples for comparison to Rocky Mountain elk in California. Five Rocky Mountain elk originally translocated from Wyoming to Tejon Ranch in Kern County, California, were sampled. Roosevelt elk from Jewell, Oregon, and translocated to Trinity County, California, between 1988 and 1995 were examined. The Nevada Department of Wildlife supplied muscle tissue samples of 30 Rocky Mountain elk, and the Idaho Department of Fish and Game provided 49 diluted DNA extracts (10 ng/pl) and 1 muscle tissue sample.

The DNA was isolated from all tissue and blood samples using Qiagen QIAmp tissue isolation kits and procedures (Qiagen, Chatsworth, California). After extraction, DNA was quantified using a Molecular Dynamics model 595 Fluorimager (Molecular Dynamics, Sunnyvale, California) using human DNA reference standards of known concentration. DNA from extracted tissue samples was diluted to a concentration of 10 ng/pl; blood extracts were not diluted.

Microsatellite analysis.—Multiplex polymerase chain reaction was used to amplify 16 tetranucleotide microsatellite markers developed specifically for elk or mule deer (*Odocoileus heniiomts:*, see Table 1 for references). All loci used were developed from enriched libraries by GIS Inc. (Chatsworth, California). These primers were selected based upon their highly repeatable polymerase chain reaction products and variability within and among the 3 subspecies of elk described herein.

Forward primers were fluorescently labeled with 6FAM. VIC. or NED (Applied Biosystems, Foster City. California) and the reverse primer had a 5'-GTTTCTT-3' extension added to the 5' end to reduce split peaks and drive the reaction to the "plus A" band (Brownstein et al. 1996). Polymerase chain reaction fragments were detected using a BaseStation DNA Fragment Analyser (MJ Research. Inc., Waltham, Massachusetts).

Each amplification cocktail included up to 20 ng of template DNA. IX PCR buffer (Applied Biosystems). 2.4 pl of multiplex specific primer concentrations (see below), 0.2 mM of each deoxynucleoside triphosphate, 2 mM MgCl2, and 0.2 U (Multiplex D. A. and E) or 0.25 U (Multiplex N) Amplitaq (Applied Biosystems) and double-distilled FLO to total 20 pl per reaction. Polymerase chain reaction primer concentrations are indicated in Table 1. Reactions containing at least 5 ng/pl DNA were run on a PTC-100 thermalcycler (MJ Research. Inc.) with the following amplification parameters: 94°C for 3 min, followed by 26 cycles of 94°C for 30 s. 58°C for 30 s, 72°C for 40 s, a final extension at 72°C for 20 min, and a final hold at !0°C. All blood samples and tissue samples containing less than 5 ng/pl DNA were amplified for 30 cycles. One microliter of polymerase chain reaction product was then added to 4 pl of loading buffer (double-distilled FLO, formamide, blue dextran. Genescan 400HD ROX [Applied Biosystems], and Genescan 500 ROX [Applied Biosystems] mixed in a ratio of 220 pl: 155.2 pl: 51.7 pl: 12 pl: 12 pl). Polymerase chain reaction products were separated using a denaturing 5.5% acrylamide gel (Long Ranger Gel Solution, Cambrex Bio Science Rockland Inc., Rockland, Maine). Gel data analysis and allele sizing were performed using Cartographer (MJ Research, Inc.).

Table 1.—Summary of loci examined in this study. This table shows in which multiplex each locus was amplified, polymerase chain reaction (PCR) primer concentration (each primer), 5' fluorescent dye label used, number of alleles, heterozygosity values observed (Ho), and the reference in which the original primer sequences can be found. Note that all the reverse primers were modified with a 5'-GTTTCTT sequence to reduce split peaks and encourage the formation of "+A" bands during polymerase chain reaction. References: 1 = Jones et al. (2002); 2 = Meredith et al. (2005); 3 = Jones et al. (2000).

Locus	Multiplex	PCR concentration (pM)	5' dye label	No. alleles	Size range (base pairs)	Ho	Reference
T108	D	0.100	6Fatn	8	136-181	0.540	1
T26	D	0.483	6Fant	12	328-398	0.565	1
T172	D	0.017	Vic	7	174-198	0.450	1
T501	D	0.600	Ned	9	252-290	0.576	1
T268	N	0.092	6Fam	6	228-256	0.437	1
T156	N	0.062	Vic	15	143-249	0.545	1
T507	N	0.062	Ned	11	148-202	0.390	1
C273	N	0.985	6Fam	8	132-166	0.553	2 and 3
TI93	A	0.706	6Fam	10	184-220	0.599	1
C2I7	A	0.212	Vic	2	185-193	0.415	1
T123	A	0.282	Ned	4	155-186	0.399	1
Cl80	E	0.048	6Fam	4	156-168	0.507	2
T107	E	0.144	Vic	4	242-265	0.326	2
C229	E	0.144	6Fam	5	299-319	0.363	2
CI43	E	0.240	Ned	4	166-178	0.492	2
cot	E	0.624	Ned	5	342-358	0.433	2

Statistical methods.—Genotypic data were collected on all 676 samples. However, only those counties or states (Idaho, Nevada, and Oregon) with at least 20 animals ($n = 632$) were used in frequency-based analyses, specifically the calculation of F-statistics and log-likelihood statistics of population differentiation. Because the alleles were not sequenced to determine the actual number of tetranucleotide repeat units, statistical models conforming to the infinite alleles model were used.

Allele frequencies, unique alleles, and observed and expected heterozygosities within counties or states ("populations") with a minimum of 20 individuals and within each of the 3 subspecies were calculated using GENEPOP on the Web (http://www.biomed.curtin.edu.au/genepop—Raymond and Roussel 1995). For frequency-based analyses, the populations of Roosevelt elk used were from Humboldt and Del Norte counties (California) and Jewell. Oregon; the populations of Rocky Mountain elk used were from Nevada and Idaho. Deviations from linkage equilibrium between all pairs of loci

across all populations and conformation to Hardy-Weinberg equilibrium on a locus-by-locus basis within populations also were tested using GENEPOP. The P-value for a significant deviation from Hardy-Weinberg equilibrium using the exact test (Guo and Thompson 1992) was adjusted from 0.05 to 0.00027 using a Bonferroni adjustment for 186 tests of the same hypothesis (16 loci by 12 populations with 6 loci being monomorphic in a population). A Bonferroni-adjusted P-value of 0.0014 was used to assess significance for multiple tests of deviation from Hardy-Weinberg equilibrium at the subspecies level (3 subspecies and 16 loci).

Quantitative measures of population differentiation (F^y) and inbreeding *(F/S)* were made among subspecies and among populations within subspecies using the software package FSTAT (FSTAT, a program to estimate and test gene diver¬ sities and fixation indices, version 2.9.3, J. Goudet, 2001; http://www.unil.ch/izea/softwares/fstat.html) as described in Weir and Cockerham (1984) after Bonferroni-adjusted pairwise significance levels. Samples from Modoc, Shasta, and Siskiyou counties were not used in the comparisons of subspecies populations because the taxonomy of elk from these 3 counties was uncertain.

Analysis of molecular variance (AMOVA; ARLEQUIN— Schneider et al. 2000) was used to evaluate the degree of population differentiation based on the relative number of repeats. Genotypic data were analyzed using subspecies, popu¬ lations within subspecies, and individuals within populations as sources of variation.

The measure of genetic distance among 12 of the county or state sampling groups was Nei's standard distance (Ds—Nei 1972), calculated in PHYLIP, version 3.5c (Felsenstein 1993) using GENDIST. The neighbor-joining method was used in NEIGHBOR (PHYLIP. version 3.5c—Felsenstein 1993).

Animals were assigned to subspecies using genotypic data and 2 population assignment software packages. WHICHRUN (Banks and Eichert 2000) and STRUCTURE 2.1 (Pritchard et al. 2000). to test accuracy of assigning to presumptive subspecies. Elk from the hybrid zones were excluded because of the confounding effects of uncertain lineage. A baseline genotype data file was constructed using known reference animals, including 367 tulc elk, 156 Roosevelt elk, and 80 Rocky Mountain elk. The tulc elk baseline reference samples consisted of animals from Contra Costa County *(n* = 65), Inyo County *(n* = 41), Lake County *(n* = 5), Marin County (n = 53). Monterey County (n = 65), and Solano County (n = 130). Roosevelt elk baseline samples included Del Norte County *(n* = 64), Humboldt County (n = 29), and Oregon *(n* = 63). Rocky Mountain elk baseline samples included elk from the states of Idaho (n = 50) and Nevada *(n* = 30).

In WHICHRUN, the probability of a given sample be¬ longing to a "critical population" was generated by a likelihood ratio log of odds score of the probabilities of the 1st and 2nd most probable population assignment given that sample's genotype. The baseline data file of the 603 samples was jackknifed, a log of odds score was generated for the most probable population assignment, and each sample was assigned to that subspecies with log of odds score of ≥1.0.

WHICHRUN was then used to assign individual elk from Modoc, Siskiyou, and Shasta counties to Rocky Mountain or Roosevelt subspecies with log of odds score of ≥1.0. Five elk from the Tejon Ranch (Kern County) and 6 elk from Mendocino County also were analyzed for subspecies verification. The 6 elk from Mendocino County were collected in 2 different locations. An individual was assumed to be a possible hybrid if the log of odds score for both Roosevelt and Rocky Mountain was ≤1.0. The same analysis parameters were used for assignment testing of baseline data and for animals of unknown ancestry.

The baseline genetic data also were tested for assignment accuracy using the program STRUCTURE using 100,000 rounds of iteration after a 10,000-round bum-in. The STRUCTURE genetic analysis program also was used to test assignment of reference elk and samples from Modoc, Siskiyou, and Shasta counties. STRUCTURE was used to estimate the number of lineages that comprise the counties or states without using a priori population information. The number of populations *(K)* was evaluated for 1—20 populations. Most likely number of populations was determined by A(K) as described in Evanno et al. (2005).

Elk were classified as potential hybrids if the most probable subspecies was <10 times more likely than the 2nd most probable subspecies, indicative of past introgression. This is mathematically equivalent to the log of odds score threshold of 1.0 used in WHICHRUN for subspecies assignment.

Results

Measures of genetic diversity.—Within the 676 samples, loci possessed from 2 alleles (locus C217) to 15 (locus T156; average = 7.3) with observed heterozygosity values ranging from 0.33 (locus T107) to 0.60 (locus T193). *FIS* estimated for the 5 herds of tule elk analyzed ranged from —0.038 (Contra Costa County) to 0.079 (Inyo County). Tule elk displayed the lowest allelic diversity and showed no more than 5 alleles at each locus (average number of alleles = 3.2), with several loci being monomorphic in some of the tule elk herds. Rocky Mountain elk averaged 6.8 alleles per locus and Roosevelt elk were intermediate with an average of 5.2.

The 16 loci did not show departures from Hardy-Weinberg equilibrium within analyzed counties or states after a Bonferroni correction. However, when data were pooled by subspecies, several loci departed from Hardy-Weinberg equilibrium. No loci deviated significantly from Hardy-Weinberg equilibrium in the 80 samples of Rocky Mountain elk. 6 loci deviated from Hardy-Weinberg equilibrium within the samples of tule elk, and 1 locus deviated significantly from Hardy-Weinberg equilibrium within the samples of Roosevelt elk.

Relationships among subspecies and populations (Table 2).—There were significant differences in allele frequencies among populations of tule elk. Exact tests of population differentiation yielded a F-value of <0.0002 and significance at all pairwise comparisons of the title elk herds (1% level after Bonferroni corrections). The overall value of *FSr* for the 5 populations of tule elk was 0.11.

Table 2.—Genetic distances among the 3 subspecies of elk *(Cervus elaphus)* in California and their populations. Data are presented for both the population and subspecific levels of comparison. Nei's standard genetic distance values are above the diagonal and F_{ST} values are below. Significance levels for pairwise tests are: *** $P = 0.001$, ** $P = 0.01$, and * $P = 0.05$ after a Bonferroni correction. The Oregon samples were collected from animals released into California from Oregon. Sample sizes for each population or herd are given in Fig. I.

	Tule elk herds					Roosevelt elk populations			Rocky Mountain elk populations		Subspecies		
	Contra Costa	Inyo	Marin	Monterey	Solano	Del Norte	Humboldt	Oregon	Idaho	Nevada	Tule	Roosevelt	Rocky Mountain
Tule													
Contra Costa	—	0.03	0.12	0.03	0.07	0.49	0.64	0.42	0.46	0.62			
Inyo	0.06*»	—	0.11	0.02	0.08	0.54	0.74	0.50	0.47	0.63			
Marin	0.19**	0.14**	—	0.10	0.08	0.42	0.61	0.34	0.37	0.45			
Monterey	0.07**	0.03**	0.13**	—	0.06	0.55	0.71	0.45	0.45	0.56			
Solano	0.12**	0.12**	0.10**	0.10**	—	0.41	0.59	0.39	0.39	0.53			
Roosevelt													
Del Norte	0.37**	0.33**	0.25**	0.34**	0.29**	—	0.18	0.09	0.31	0.53			
Humboldt	0.47**	0.42**	0.34**	0.42**	0.37**	0.12*	—	0.25	0.47	0.61			
Oregon	0.40**	0.37**	0.27**	0.37**	0.31**	0.06*	0.16*	—	0.17	0.31			
Rocky Mountain													
Idaho	0.33**	0.28**	0.21**	0.28**	0.27**	0.14**	0.19**	0.13**	—	0.09			
Nevada	0.38**	0.33**	0.25**	0.33**	0.31**	0.20**	0.24**	0.18**	0.03*	—			
Subspecies													
Tule											—	0.55	0.48
Roosevelt											0.30*	—	0.31
Rocky Mountain											0.28*	0.14*	—

Exact tests of population differentiation, as measured by allele frequencies, were highly significant ($P < 0.0002$) among populations of Roosevelt elk (Oregon and Humboldt and Del Norte counties) and among populations of Rocky Mountain elk (Nevada and Idaho). F_{ST} values among populations of Roosevelt elk ($F_{ST} = 0.096$) and between populations of Rocky Mountain elk ($F_{ST} = 0.03$) were less than those observed among herds of tule elk. Individual populations of Roosevelt and Rocky Mountain elk showed significant differentiation at the 5% nominal level after Bonferroni corrections.

Data from the 3 subspecies were analyzed as a whole and tested for population differentiation using subspecies as the source of variation (Table 2). A highly significant Exact test ($P < 0.0002$) suggested that there were greater differences in allele frequencies among the 3 subspecies than among populations or herds within any of the 3 subspecies. Pairwise tests of differentiation between the 3 subspecies were all significant at the 5% nominal level of significance after a Bonferroni correction. The AMOVA results (Table 3) indicated that the subspecies are well differentiated.

STRUCTURE yielded results, both in terms of K populations and A(K), that suggested the sampled elk are from 2 "populations": tule and Roosevelt-Rocky Mountain elk lineages. Although the likelihood values for K = 1-20 populations approached a maximum at $K = 3$ populations, the A(K) values spiked at $K = 2$ populations.

Subspecies clustered distinctly, with 100% bootstrap support between tule elk and the other 2 subspecies (Fig. 2). The node separating the 2 Rocky Mountain elk populations (Idaho and Nevada) from the other subspecies populations had a 94% level of bootstrap support.

Assignment testing.—All of the 367 samples presumptively categorized by wildlife managers as tule elk assigned correctly using both WHICHRUN and STRUCTURE (Table 4). STRUCTURE was slightly more accurate in assigning reference elk to their presumptive subspecies, although both programs yielded a very high success rate of correct assignment. Population assignment of Roosevelt and Rocky Mountain elk had a small error rate (<5%), which varied by analysis program. One presumptive Roosevelt elk collected from eastern Oregon (Bend, Oregon) was assigned to the Rocky Mountain subspecies with >3.0 log of odds score.

Assignment testing of individual elk using both STRUCTRE and WHICHRUN (Table 5) revealed that Modoc, Shasta, and Siskiyou counties were inhabited by Rocky Mountain, Roosevelt. and hybrid elk. The same individuals were identified as hybrids by both programs. The 5 individuals from the Tejon Ranch in Kent County were correctly assigned as Rocky Mountain elk. The 6 elk from Mendocino County consisted of 2 Roosevelt elk and 4 tule elk.

Table 3.—Analysis of molecular variance of 3 subspecies of elk *(Cervus elaphus)* in California using subspecies, populations within subspecies, and individuals as sources of variation. Samples were collected from 1997 through 2003.

Source of variation	'1/	Sum of squares	Variance components	Percentage of variation (%)
Among subspecies	2	905.12	1.253 Va	24.18
Among populations within subspecies	7	319.94	0.3631 Vb	7.00
Within populations	1.170	4,174.93	3.568 Vc	68.81
Total	1,179	5.399.99	5.185	

Friends of Del Norte

Conserving our Natural Heritage Since 1973

Protecting the Wildlands, Waters and Wildlife
Of the Del Norte County Region

P.O. Box 144, Crescent City, CA 95531 707 954-1969 or 707 465-8904

April 4, 2019

Transmitted by email on this date to the California Department of Fish & Wildlife
Via staff addresses below:
Victoria.Barr@wildlife.ca.gov; fgc@fgc.ca.gov

California Fish and Game Commission
Valerie Termini, Executive Director
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Commissioners and Staff:

We are submitting this today to meet the deadline for inclusion in the packet for Fish & Game Commissioners for their April meeting. Thank you as always for the opportunity to participate in this process. These comments focus on the North Coast Roosevelt Elk Management Unit, (also referred to as Northwestern California Hunt Zone). The "Document" referenced throughout these comments is the Draft Supplemental Environmental Document ELK HUNTING prepared by California Department of Fish & Wildlife (CDFW) and dated February 14, 2019.

Summary

We appreciate that CDFW integrated their presentation to discuss the combined impacts of all hunt categories (PLM, SHARE, General), in response to our scoping comments. This makes the process more transparent and less fragmented. However, you have a legal obligation to address our other scoping comments, which CDFW fails to do. (Our

scoping comments follow in Appendix B.)

Unfortunately the CDFW Document is outdated and contains critical misrepresentations, errors, and incomplete analysis. Historical and relevant harvest numbers that we have been provided by the California Department of Fish & Wildlife upon request, as well as important and relevant 2017—2019 elk count numbers and longer-term studies that are available from Redwood National & State Parks should be made part of the record and presented to the public and to the Commissioners with a review period to allow informed decisions. The Parks are in the heart of the Northwestern Hunt Zone, but their data is ignored. We have made this comment many times before. (See Attachments and Appendices.) The Elk Pop computer model scenarios should be re-calculated to correct errors and misrepresentations, which will change the results and cause the entire document to be re-issued. Otherwise CDFW is vulnerable to legal challenge.

CDFW's failure to provide historic data and paint the "big picture" for the public means that this Document is fragmenting and obscuring the CEQA process, again leaving the public and the Commissioners without the necessary tools for judgement.

We are aware that the general public in Del Norte is excited about the return of the Roosevelt elk. Yet the comments that we and other regional non-profit organizations have made repeatedly, since 2015, regarding these elk hunts and the Statewide Management Plan are for the most part ignored in CDFW final documents. CDFW has a legal obligation to address all comments, and the Commissioners, based on their new mission statement, want to see a fully transparent and accessible process allowing meaningful public participation. Instead this Document emphasizes only and repeatedly the **conflicts** with elk. It suggests to us that commercial interests have the ear of CDFW, which does not give proportional voice to non-profit groups that represent memberships of the public.

Moreover the CDFW strategy appears concerned *only* with *shooting* elk, even now signaling their intent to make greater use of depredation permits. We have previously suggested alternative solutions to "conflicts" which CDFW has ignored, such as: providing financial assistance for elk fencing, shown to be effective for small ranches; conservation easements on larger ranches to support elk corridors to allow movement between coastal and upland environments, and elk overcrossings and undercrossings.

The CDFW strategy violates the Statewide Elk Management Plan, which recommends making public lands more attractive to elk as an alternative; in Del Norte County 80+% of the land is public trust land and in concept available for elk.

We note that today April 4th the California Wildlife Conservation Board has announced that the " Wildlife Corridor and Fish Passage solicitation under Proposition 68 is now available. Priorities include construction of wildlife overcrossings and undercrossings, restoration of natural habitats that provide a visual screen in wildlife corridors..."

Our organization finds that it cannot support any of the project alternatives, because of the errors in the analysis. Even if we wanted to support the "current conditions/no project" alternative, we could not because it is not clear what number this would be, 65 or 80, and it is not clear what impacts this is already having or will have in future. We would like to see further growth in the herds (so that the Roosevelt elk herds re-occupy all of their historic range) based on actual counts or based on a clear, detailed explanation of what the actual counts are; how they are collected, and how population numbers are derived from actual counts. There is no alternative in the Document that allows this.

1) Errors, Inconsistencies and Misrepresentations in Document

A summary of all past elk harvest for the Northwest hunt provided by CDFW is contained in our Appendix A, except that 2018 harvest numbers are given on page 18 of the Document (as total 2018 harvested hunt, PLM, SHARE, General, was: bulls: 45 + antlerless 35 = 80.) As clearly stated on page 6 of the Document, *the baseline or current condition is 2018/2019 for the no project alternative*, which is the harvest of about 80. Yet the Elk pop model run for the no project alternative uses only 65 elk.

The historic progression of the harvest is summarized:

2013- total harvest 45
2014- total harvest 45
2015- total harvest 68
2016- total harvest 62
2017- total harvest 73, and 85 tags were issued
2018- total harvest 80, and 88 tags were issued

The Document also fails to provide or analyze the historic information. If it did, we would see that **from 2014 to 2018 CFG allowed the elk harvest to increase by 77%** [(80-45)/45] . Yet during this same time period when the elk harvest nearly doubled, there were no environmental documents; no actual field elk counts until 2017, and no transparent, coherent historic analysis whatsoever – were ever provided to the public.

Elk population **models** in the Document on pages 58 and 59 show current conditions and the no project alternative, as a **harvest of only 65 elk:**

"Appendix 3. Computer Model Runs (Elk Pop) Harvest NORTHWESTERN CALIF. ELK HERD SIMULATION- GENERAL, PLM, SHARE TAGS, 2019 (Combined Harvest for Del Norte and Humboldt cos) Ratio = 37/100/32 - Maximum Calf Survival = 40% THIS PROGRAM CALCULATES CHANGES IN HERD CHARACTERISTICS BASED ON VARIOUS HARVEST RATES. CURRENT CONDITIONS = NO CHANGE. GENERAL, COOP ELK, SHARE AND PLM TAGS TO HARVEST APPROXIMATELY 44 BULLS AND 21 ANTLERLESS ELK"

However, the actual current baseline conditions are that for the last two years, there has been a hunt that issues greater than 80 tags and results in a harvest that approaches 80. *Not 65.* There has been a misrepresentation of current baseline conditions in the population modeling documents. This is internally inconsistent, and is confusing as to how the model was manipulated. The Document contains a serious error.

Likewise, the proposed alternative is misrepresented:
In the population model, page 62, the proposed harvest is stated as approximately 85:
"PROPOSED PROJECT: ADD 8 BULL AND 12 ANTLERLESS (SHARE) TAGS TO **HARVEST** APPROXIMATELY 52 BULLS AND 33 ANTLERLESS ELK"

The total proposed harvest, as stated on page 18:
The proposed project will result in increasing the total tags to allow removal of up to 108 Roosevelt elk.

The proposed harvest of 108 is significantly larger than the proposed project **model** run of 85.

What is alarming is that the models run clearly show that if you run the actual current conditions of a harvest of approximately 80-85, the herds do not grow significantly, but remain stable.

The Department of Fish and Wildlife has significantly and incrementally increased elk harvest size since 2014 by 77%, so that the significantly increased harvest belatedly described in this Document – **has already been implemented.** Already implemented – we would underline again – **without** appropriate elk count/population data analysis and without environmental documents. The harvest numbers have increased substantially *every single year* since 2014, without environmental documents and through 2017

without a Statewide Management Plan. Current baseline conditions of harvesting 80-85 elk already constitute implementation of a greatly increased harvest. The models show that this amount of harvest, page 62, will result in stable or possibly a slight decrease in herd size. Any harvest above this amount is shown to decrease herd size significantly.

Therefore our organization finds that it cannot support any of the project alternatives, because of the errors in the analysis. Even if we wanted to support the "current conditions/no project" alternative, we could not because it is not clear what number this would be, 65 or 80, and it is not clear what impacts this is already having or will have in the future. We would like to see further growth in the herds (so that the Roosevelt elk herds re-occupy most of their historic range) based on actual counts or based on a clear, detailed explanation of what the actual counts are; how they are collected, and how population numbers are derived from actual counts. There is no alternative in the Document that allows this. CDFW has failed to provide an alternative which would *decrease* the number of tags issued and elk harvested.

The Elk pop model run shows a decrease in the recovering Roosevelt elk herds which is in conflict with the goals of the Statewide Management Plan. This is also in conflict with the desires of the general public.

2) <u>How Many Elk are Out There??</u>

The Document fails to document in any way the alleged conflicts between landowners and elk, which are most likely being "reported" to CDFW by larger commercial operations. Document tone is negative about the elk "problem" and repeatedly uses the word "conflict." It is silent on the widespread public interest in the recovery of the elk herds. Nor does it mention the contribution to tourism, on which our regional economies are now heavily dependent. Unfortunately overall the enthusiastic general public is not aware of the CDFW/CFG elk hunt process.

However as some indication of fervid public interest in elk recovery, we offer the following: Redwood Parks Conservancy and Tolowa Dunes Stewards (two non-profit organizations providing support to state and federal agencies) have on August 13, 2017 and August 26, 2018 hosted open public presentations in Del Norte County about the Roosevelt elk monitoring programs being conducted by Humboldt State University (HSU) and CDFW. As Del Norte County has fewer than 30,000 residents, these Sunday afternoon programs were very well-attended, with 38 and 51 people, respectively. (Susan Calla, personal communication) It was obvious that all attendees felt positive

about the elk. These attendees sat in uncomfortable metal chairs in a small, unventilated room, totally fascinated as team members presented a broad range of detail and data. There was some natural history of elk but primarily the focus was on all the different data collection methods being employed by the team. Presentation and questions continued for 2-3 hours. Some photos, recordings, and notes were taken. (Sandra Jerabek, personal communication) The public soaked up a wealth of information and explanation, which is now in sharp contrast to the sparse explanations of data and leaps of faith in this Document.

As part of the above referenced public presentations:

On August 13, 2017 Carrington Hilson of CDFW said there were 300 elk in Del Norte in fall of 2016, and further that up through this point in time the data was more or less "anecdotal." A more scientific approach had been launched in 2017 by CDFW and Humboldt State University Department of Wildlife. According to Hilson, the population increased to 400 or 440 in Del Norte and to 990 for the Northwestern zone in 2017. In Hilson's presentation on **August 26, 2018**, she said that there were "nearly 1,000 in the zone," and between "400-500 in each county." *But she also stated in the 2018 presentation that: "between 113 and 429 is the actual count in the Northwest Hunt Zone."* This implies that the team (including HSU professors and students) *might* be using their own projection model to arrive at their population numbers of 990 or 1,000. Hilson stated many times that it was challenging to count elk with all of the forest cover.

As counting elk might be challenging, in the 2018 public presentation HSU Professor Micaela Szykman Gunther also explained in detailed slides a mathematical formula that the HSU team had developed to project elk population/abundance estimates from field data, in this case from their collection of fecal DNA.

The Document on page 22 states "direct counts within a portion of the zone from 2016 to 2017 resulted in a minimum count of 990 elk in 22 distinct groups (CDFW 2018)." (This number 990 is the same number Hilson gave as total elk numbers at the public presentation in 2017, without any qualification as to it being the minimum count or covering only a portion of the zone.) From here the Document on page 22 goes on to state: "...using the minimum count of 990 from only a portion of the entire zone, conservatively assumes the current population size is 1,600 elk and carrying capacity is estimated at 1,760 elk across the entire zone." There is no explanation whatsoever of how the Document takes this leap from a population of 990 elk to 1,600 elk. No formula or or explanation of any accepted method is offered here.

The discussion of actual elk population data on page 22 of the Document is deficient. There is no explanation of what "portions" of the zone they are referencing. Hilson's numbers of 990 in 2017 and then nearly 1,000 in 2018 were not qualified as partial in the public presentations, and do not suggest that as stated in the Document on page 22 "elk populations are growing and expanding within the unit" to any appreciable extent. In fact, the brief *two* year period of time that CDFW has been surveying northwest elk is not long enough to establish a trend.

The Document also fails to give even the 2018 or early 2019 elk field counts, thus it is outdated and incomplete. Also, by failing to provide the most recent data CDFW is fragmenting the CEQA process, leaving us wondering when that data will be presented, considered and factored in. Further where is the explanation of how field data is collected? Where is the detailed explanation of how final population numbers are derived from field counts? Certainly this is *not* in this Document either. We are left to speculate. We are left to take it on faith.

Is CDFW using their own internal method to project population from field counts? Are they using the mathematical formula that HSU Professors have developed? Have these methods been published and peer reviewed? Or perhaps, in the worst possible case scenario, are field counts being projected from actual data twice, once by the HSU/CDFW team and once again by CDFW in preparing the Document? Reading the Document there is no way of knowing.

CDFW then uses 1,600 as the supposedly real population number in the Elk pop computer scenarios. Given these Roosevelt elk herds are recovering (from being nearly extirpated) and have unique genetics, perhaps the conservative number of 990 should be used to run the scenarios (after clarifying how *that* number was obtained). CDFW is obligated to explain more precisely how they got the number of 990 elk, as well as to explain the 62% leap from 990 to 1600 elk. The elk-loving public deserves this.

Frankly we had expected CDFW to incorporate and explain to the public the connection between the field data that CDFW and HSU team is collecting and CDFW actions in already allowing such large increases in elk hunting from 2013 to 2018. Failure to do so leaves a significant gap in the information that CEQA is supposed to provide.

3) **<u>Redwood National & State Parks studies do not support CDFW leap of faith in elk population growth projections</u>**

In reference to the attached **Redwood National & State Parks, 2017 HERD UNIT CLASSIFICATION AND MANAGEMENT OF ROOSEVELT ELK:**

Redwood National & State Parks has been surveying park elk since 1997, and the results are shown in figure 1, page 5.

This chart shows that since 1997, the population for these studied herds is stable or declining. (The OSOC herd appears to spike only because during 2015 the LRCR herd discontinued and was absorbed by OSOC.) The chart shows EPBY and GOBB herds to be in decline. The DARA herd has only slightly increased. Overall, the Redwood National Park elk do not exhibit growth, but rather show a decline of cows during this long study period. Most of these herds do not have hunting pressure, and yet they have declined. Also, figure 2, page 7 of the report shows bull to cow ratios for the EPBY and DARA herds have decreased significantly from 2008 to 2017. This indicates that herds that have declining cow populations also have proportionally greater declines of bulls. Appendix A in the Redwood Parks study is the last page, with useful population data.

In addition to misrepresenting the harvest size of the proposed project within the CDFW Document models, these models use an exaggerated population base of 1,600, rather than the actual population results of the CDFW survey data, which *may* be approximately 1,000 for Del Norte and Humboldt zone herds combined. Considering that the Humboldt County Redwood National & State Parks elk surveys/management studies have been conducted over a longer period of time to assess population trends, and show an overall decline in elk population, the inflated population base of 1,600 is doubtful. How can it be "conservative"?

4) **<u>Failure to respond to all scoping comments: Tribal hunt allocations</u>**

We have requested in our scoping comments and in comments on the draft Management Plan that Tribal hunting allocations be given the first priority, with free or discounted tags for Tribal members because this is subsistence food, and that Tribal hunts be coordinated with other hunts to ensure that a particular herd is not overly impacted. These comments have never been addressed by CDFW or the Commission.

5) **Failure to respond to all scoping comments: Unique Genetics of these Herds**

The discussion of genetics in the Document on page 23 is too general to be of value. The documents talk about impacts to the statewide gene pool but not to the genetically pure or unique "Redwood elk" as per EPIC's previous submitted comments and attachments on elk hunts and Management Plan. Attached once again are the genetic studies suggesting that the elk that are hunted in this zone are important because they may be genetically unique. Again they deserve a truly conservative approach, special management and further study. These comments have never been addressed by CDFW or the Commission.

Thank you, Commissioners for your new mission statement; your dedication to transparency and public participation, and your careful attention to this process.

Sincerely,

Joe Gillespie

Joe Gillespie
President
Friends of Del Norte

Attachments:

- Redwood National & State Parks, 2017 Herd Unit Classification and Management of Roosevelt Elk (RNSP 2017)
- Elk genetics studies: Meredith; Polziehn.

Appendix A: Details of Elk Harvest 2013-2014

----- Forwarded Message -----
From: "Hilson, Carrington@Wildlife" <Carrington.Hilson@wildlife.ca.gov>
To: "upsprout@yahoo.com" <upsprout@yahoo.com>
Cc: "Fresz, Shawn@Wildlife" <Shawn.Fresz@wildlife.ca.gov>; "Barr, Victoria@Wildlife" <Victoria.Barr@wildlife.ca.gov>
Sent: Wednesday, December 5, 2018 4:17 PM
Subject: Elk Tags Allocated in Del Norte and Humboldt Counties

Ms. Cooper,
Per your request that you made during our conversation last Thursday, I have compiled the number of allocated elk tags and reported harvest for all PLM, SHARE, and general hunts in Del Norte and Humboldt counties from 2013 to 2017.

Year	Hunt Code	Hunt Name	Gender	Tags Allocated	Harvest
2013	402	Big Lagoon antlerless	either-sex	5	1
2013	403	Big Lagoon bull	bull	5	3
2013	404	Klamath antlerless	antlerless	5	0
2013	405	Klamath bull	bull	5	3
2013	413	Del Norte antlerless	antlerless	10	8
2013	414	Del Norte bull	bull	5	5
2013	483	Northwestern California either-sex	either-sex	20	19
2013	PLM	Cottrell Ranch	bull	1	1
2013	PLM	Fulton Ranch	bull	1	0
2013	PLM	Hunter Ranch	bull	1	0
2013	PLM	Redwood House Ranch	bull	1	1
2013	PLM	Stover Ranch	bull	4	4
2013	PLM	Stover Ranch	antlerless	2	1
2013	PLM	Wiggins Ranch	bull	2	2
2013	PLM	Wiggins Ranch	antlerless	2	0
2014	403	Big Lagoon bull	bull	5	5
2014	405	Klamath bull	bull	5	1
2014	483	Northwestern California either-sex	either-sex	30	25
2014	PLM	Cottrell Ranch	bull	1	0
2014	PLM	Cottrell Ranch	antlerless	1	1
2014	PLM	Fulton Ranch	bull	1	1
2014	PLM	Hunter Ranch	bull	1	1
2014	PLM	Redwood House Ranch	bull	1	1
2014	PLM	Smith River	bull	3	3
2014	PLM	Stover Ranch	bull	4	2
2014	PLM	Stover Ranch	antlerless	2	1
2014	PLM	Wiggins Ranch	bull	2	2
2014	PLM	Wiggins Ranch	antlerless	2	2
2015	483	Northwestern California either-sex	either-sex	45	35
2015	PLM	Alexandre Eco Dairy Farms	bull	2	2
2015	PLM	Alexandre Eco Dairy Farms	antlerless	4	4
2015	PLM	Big Lagoon	bull	3	2

2015	PLM	Cottrell Ranch	bull	1	1
2015	PLM	Cottrell Ranch	antlerless	1	1
2015	PLM	Fulton Ranch	bull	1	1
2015	PLM	Hunter Ranch	bull	1	1
2015	PLM	Klamath	bull	2	2
2015	PLM	Redwood House Ranch	bull	1	1
2015	PLM	Smith River	bull	3	3
2015	PLM	Smith River	antlerless	6	6
2015	PLM	Stover Ranch	bull	4	4
2015	PLM	Stover Ranch	antlerless	2	1
2015	PLM	Wiggins Ranch	bull	2	2
2015	PLM	Wiggins Ranch	antlerless	2	2
2016	355	Northwestern California bull	bull	15	12
2016	PLM	Alexandre Ecodairy Farms	antlerless	4	4
2016	PLM	Alexandre Ecodairy Farms	bull	2	2
2016	PLM	Big Lagoon PLM	antlerless	2	2
2016	PLM	Big Lagoon PLM	bull	3	3
2016	PLM	Cottrell Ranch	antlerless	1	0
2016	PLM	Cottrell Ranch	bull	1	1
2016	PLM	Fulton Ranch	bull	1	1
2016	PLM	Hunter Ranch	bull	1	1
2016	PLM	Klamath PLM	antlerless	2	2
2016	PLM	Klamath PLM	bull	3	2
2016	PLM	Redwood House Ranch	bull	1	1
2016	PLM	Smith River PLM	antlerless	6	6
2016	PLM	Smith River PLM	bull	3	3
2016	PLM	Stover	antlerless	2	2
2016	PLM	Stover	bull	4	3
2016	PLM	Wiggins Ranch	antlerless	2	1
2016	PLM	Wiggins Ranch	bull	2	2
2016	SHARE	Copher Ranch	antlerless	1	1
2016	SHARE	Copher Ranch	bull	1	1
2016	SHARE	Del Norte North	antlerless	6	5
2016	SHARE	Del Norte North	bull	3	3
2016	SHARE	Del Norte South	antlerless	6	2
2016	SHARE	Del Norte South	bull	3	2
2017	355	Northwestern California bull	bull	15	15
2017	483	Northwestern California either-sex	either-sex	3	2
2017	PLM	Alexandre Ecodairy Farms	antlerless	4	4
2017	PLM	Alexandre Ecodairy Farms	bull	2	2
2017	PLM	Big Lagoon PLM	antlerless	2	0
2017	PLM	Big Lagoon PLM	bull	3	3
2017	PLM	Cottrell Ranch	antlerless	1	1
2017	PLM	Cottrell Ranch	bull	1	1
2017	PLM	Fulton Ranch	bull	1	0
2017	PLM	Hunter Ranch	bull	1	1
2017	PLM	Klamath PLM	antlerless	2	1
2017	PLM	Klamath PLM	bull	3	2
2017	PLM	Redwood House Ranch	bull	1	1
2017	PLM	Smith River PLM	antlerless	6	6
2017	PLM	Smith River PLM	bull	3	3
2017	PLM	Stover	antlerless	2	1
2017	PLM	Stover	bull	4	4
2017	PLM	Wiggins Ranch	antlerless	2	1

2017	PLM	Wiggins Ranch	bull	2	2
2017	SHARE	Copher Ranch	antlerless	2	1
2017	SHARE	Copher Ranch	bull	1	1
2017	SHARE	Del Norte North	antlerless	11	10
2017	SHARE	Del Norte North	bull	1	1
2017	SHARE	Del Norte South	antlerless	7	7
2017	SHARE	Del Norte South	bull	5	3

Please let me know if you have any questions regarding this information.

Carrington Hilson
Environmental Scientist
California Department of Fish and Wildlife
Email: carrington.hilson@wildlife.ca.gov
Cell: 707-502-4078

Appendix B: Friends of Del Norte Scoping Comments

This is an exact copy of what we submitted in November, except for the footer and page numbers:

November 30, 2018

Transmitted by email on this date to the staff addresses below:
Victoria.Barr@wildlife.ca.gov; Joe.Hobbs@wildlife.ca.gov; fgc@fgc.ca.gov

California Fish and Game Commission
***Valerie Termini*, Executive Director**
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Commissioners and Staff:

RE: **Scoping Comments for environmental documents and proposed tag quota increase in the Northwestern Elk Zone of 20 tags, as per Victoria Barr communication on November 19, 2018 -- 4 pages.**

Thank you for the opportunity to participate in this process. The Friends of Del Norte will focus the scope of these comments on the North Coast Roosevelt Elk Management Unit, (also referred to as Northwestern California Hunt Zone).

First we make three general requests right up front, and then we bullet all the information that we believe you will be obliged to include in any forthcoming environmental documents.

***First, we suggest again that Tribal hunting should be the first and highest priority for existing hunting tags.** In other words the allocations for Tolowa Dee-ni' Nation, Elk Valley Rancheria, and the Yurok Tribe should be established *before* the PLM, SHARE and general hunt allocations are set. Tags for Tribal members should also be free of cost or at least affordable according to a standard determined by the Tribal governments, as the PLM tags are not affordable and 2017 tag increases were primarily in the SHARE program. If Tribes have a "share" in the SHARE program, this is not transparent.

Tribal hunting should be coordinated overall, in a transparent manner, with other CDFW sanctioned hunting so that individual herds are not overly impacted, but in any case Tribal members should have priority and affordable opportunity to hunt elk.

***Second, please separate the Del Norte hunt from the Humboldt hunts.**

By combining the hunts of Humboldt County (primarily affecting the herds that take refuge in Redwood National Park and/or State Parks) and Del Norte County, there is the false impression that hunting stress is not harmful overall. However, hunting is not allowed in the Redwood Parks, where the elk populations are large. Therefore the small herds of Del Norte are taking the majority of stress from hunting. This is obscured by combining the two counties. Also consider that Del Norte herds have already experienced a significant increase in hunting since 2013, when there were no Smith River PLM or Alexandre PLM and no SHARE hunts. This has increased to currently in 2017 to 9 Smith River PLM, 6 Alexandre PLM, plus 12 SHARE hunts (Pers. Communication, Carrington Hilson, CA Dept. of Fish and Wildlife, 2018 Nov. 29). This additional hunting pressure represents an increase of 27 elk specifically taken from Del Norte, and a very rapid increase from zero to 27 within only five years. Adding these new PLM and SHARE hunts to the general hunt pressure, and the results of increases far exceeds any growth of the Del Norte herds proportionally.

***Third, of great biological importance also is that based on existing science the Roosevelt elk in the Northwest CA Hunt Zone are genetically pure or unique** (see previous comments from Friends of Del Norte, EPIC). Please consider this factor.

***Fourth, on behalf of the concerned public, we would greatly appreciate the transparency if the environmental documents would also address the following:**

- Present in detail, all elk population data collected to date and used as a basis for any proposed increase in hunting tags.

- Present all data showing how many elk are actually killed each year in each program including PLM and SHARE, Tribal hunts, and including poached elk (e.g. recent 2018 poaching in Redwood National & State Parks; 2018 apprehended poachers in Gilbert Creek area) and road kill. Please show respective locations on a map, or at least break out by County and general areas within counties.

  We request improved transparency throughout the process. Proposed numbers of tags and categories for all hunts: General, SHARE, PLM, Apprentice, Tribal, etc. should easily accessible such that a given agency, region or county can grasp and analyze the impacts to their region, county or neighborhood. These proposed quotas should be locally published well before the Commissioners' meeting dates so communities have a greater opportunity to voice their support or concerns.

- Indicate which elk population data are based on actual field counts, surveys and other methods involving actual sighting or handling of the elk by authorized personnel -- and which population data are projected from field data by mathematical formulas and other methods in use by the Humboldt State University (HSU) /CDFW team (and/or other experts consulted by this team).

- Explain clearly which of these methods for projecting elk population numbers are being used; where else and by whom these methods are in use, and to what extent these projection methods have been published and peer-reviewed.

- Note if any portion of the population counts/data is based directly on reports/counts from the public (or local businesses or ranches etc.).

- Chart the progression or changes in estimated elk population numbers and/or data-based population numbers over the last 10 years, and over the last 150 years.

- Explain how proposed hunting tag increases will fulfill the existing or draft Elk

Management Plan population goals for this region.

- Discuss how elk are significantly impacted by recent fires in surrounding areas of Southern Oregon and Northern California, and how this combined with any proposed increased hunting pressure impacts the elk in the Northwestern CA Hunt Zone.

  We should compensate by allowing elk to increase their numbers and find refuge in nearby areas such as ours, to compensate for losses in elk or elk habitat.

- Explain all reason(s) including biological justification for the proposed increase in elk tags when the HSU/CDFW data gathering and studies are not complete, have not been published, released, or peer-reviewed.

  CDFW is proposing for the 2018 Elk Tag Allocation adjustments within the quota ranges allowed under the old outdated elk management plan, a plan not supported by scientific evidence.

- Show how the proposed increase in tags is spread over the categories of General Hunt; PLM; SHARE, and the allocation for Tribal Hunts/Tags. Please show respective locations on a map, or at least break out by County and general areas within counties.

We also attach our previously submitted comments on the draft elk management plan for your convenient reference, as these comments continue to be relevant to your process.

Again Friends of Del Norte thank staff and the Fish and Game Commission for the opportunity to comment.

Sincerely,

Joe Gillespie

Joe Gillespie
President
Friends of Del Norte

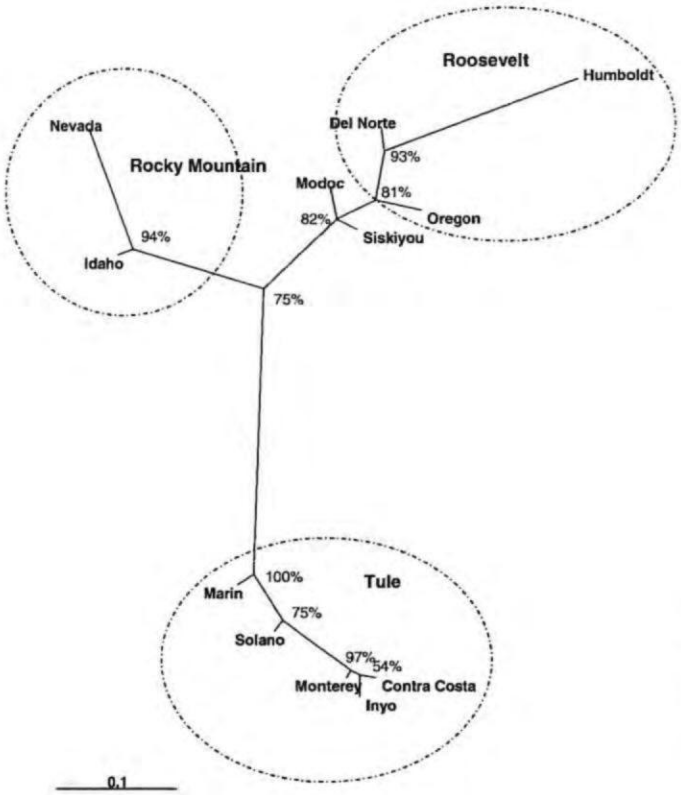


Fig. 2.—Unrooted tree of Nei's standard genetic distance after bootstrapping the data 1.000 times. The bootstrap level of support (out of 1,000) is indicated at each node. Included are all populations of elk with at least 20 samples.

Discussion

Title elk have much reduced microsatellite variation compared to the Roosevelt and Rocky Mountain elk sub¬species, as expected given the severe population bottleneck in the late 1800s. The low level of genetic variability in the tule elk was likely due to the low numbers of founders rather than insufficient sampling, because sampling collections were well distributed among herds. Thus, the molecular genetic unique¬ness of the tule elk resulted from lack of genetic variation, not from novel genetic variability.

Tule elk may have been reduced to 1 breeding pair in 1874 (McCullough et al. 1996). Barring a mutation event or experimental error, the presence of 5 alleles at 1 locus requires that the tule elk subspecies was reduced to no fewer than 1 female and 2 males, or vice versa. Allele frequencies varied significantly among the herds of tule elk. The results also suggest that the herds in Contra Costa, Inyo, and Monterey counties were more closely related than the other 2 herds of tule elk; the Marin herd was the most distantly related. This also was reflected in the phylogenetic results (Fig. 2) and follows logically from historical information on relocations (McCullough et al. 1996). Because all tule elk originated from the same herd, founder effects and genetic drift likely caused the herds to diverge genetically in spite of relocation efforts.

Table 4.—Assignment test results for 3 subspecies of elk *(Cenus elaphus)* in California using programs WH1CHRUN and STRUC¬TURE 2.1. The numbers of correct assignments are on the diagonal and incorrect assignment counts are off the diagonal for each program.

Software	Subspecies	*n*	Tule	Rooseveil	Rocky Mtn.
WHICHRUN	Tule	367	367	—	—
	Roosevelt	156	—	151	5
	Rocky Mountain	80	—	1	**79**
STRUCTURE 2.1	Tule	367	367	—	—
	Roosevelt	156	—	154	1
	Rocky Mountain	80	—	—	**80**

Table 5.—Assignment tests of elk from Modoc, Siskiyou, Shasta, and Kern counties, California, using programs WHICHRUN and STRUCTURE. Animals arc noted as potential hybrids using WHICHRUN when the log of odds score of assignment was less than 1.0. and when the probability of assignment was less than 10 times the 2nd most probable subspecies using STRUCTURE.

	County			
Program	Modoc (n = 20)	Siskiyou <« = 23)	Shasta (n = 7)	Kent 0i = 5)
WHICHRUN				
Roosevelt	9	15	1	0
Rocky Mountain	10	2	5	5
Hybrid	1	5	1	0
STRUCTURE 2.1				
Roosevelt	9	15	1	0
Rocky Mountain	to	2	5	5
Hybrid	1	5	1	0

Although tule elk do not currently display the effects of reduced fitness, such as low reproductive output and mor¬phological deformities, the individual herds are definitely al risk if they remain genetically isolated. However, reduced genetic variation at neutral loci does not necessarily indicate a lack of adaptability (Hedrick 1999, 2001) and would not warrant intentional crossbreeding with Roosevelt or Rocky Mountain elk.

We propose the following management recommendations for tule elk given the genetic data and their life-history characteristics. Management of tule herds should continue to involve the movement of animals, preferably mature females, between the tule herds. Adult female elk would be much more likely to contribute genetically because of the harem mating structure, because an introduced male elk would likely have to establish dominance before breeding. Translocating elk among Inyo, Contra Costa, and Monterey counties should not nega¬tively impact genetie diversity of these 3 herds, because they are closely related.

Periodic monitoring of the physical health and genetics of the tule herds is required in order to detect a rise in frequency of deleterious inherited phenotypes, reduced fitness, and other effects of inbreeding. Although the 6 elk samples from Mendocino County were either pure tule or pure Roosevelt and did not indicate crossbreeding, the elk in the Mendocino and Lake county areas should be monitored for hybridization. The tule and Roosevelt elk sampled were from 2 differ-

ent locations and did not occur sympatrically. Tule elk in Mendocino County have recently been detected in close proximity to Roosevelt elk (R. Schaefer, in litt.). Introgression of Roosevelt elk into these tule herds should prohibit their use for future transplants.

The reproductive strategy of elk makes this species vulnerable to the loss of genetic diversity. Williams et al. (2002, 2004) applied theory and computer simulation to conclude that elk in small isolated herds tend to lose genetic variation and heterozygosity. The effect of small population size is magnified by the highly polygynous nature of elk, and even brief bottlenecks can have a large effect on the number of alleles and heterozygosity of species with this mating system.

The effects of a small population size on a mammal are well illustrated by research on Florida panthers *(Puma concolor coryi).* Hedrick (2001) suggested that populations that remain small over a long time period would incur a large genetic load from fixation of many deleterious alleles of small effect, as seen in the Florida panther. Even with an effective population size of 30-50, this subspecies of panther so rapidly accumulated deleterious alleles through drift and inbreeding that it was in serious danger of extinction (Hedrick 1995).

Population assignment for individual reference elk with known source populations using multilocus genotype data was concordant with source population records because of highly significant differences in allele frequencies observed between the subspecies. Two population assignment software programs. WHICHRUN and STRUCTURE, yielded nearly identical assignment accuracies. This high degree of accuracy is important from a forensic standpoint because tule elk are a heavily managed subspecies within California; recaptured escapees from game refuges and evidence from suspected cases of tule elk poaching now can be reliably identified to subspecies.

Elk present in the northern California counties of Modoc, Siskiyou, and Shasta arc genetically Roosevelt elk, Rocky Mountain elk, or hybrids of these 2 subspecies. Thus, trophy elk taken by sportsmen from these counties cannot be reliably assigned to subspecies in the absence of molecular genetic information. The unique genetic character of Roosevelt elk from California merits careful monitoring of translocations of elk if new animals are moved into the existing herds in Humboldt anil Del Norte counties from areas containing elk of mixed ancestry.

Our analyses lend strong support to previously published work suggesting that tule, Roosevelt, and Rocky Mountain elk should be designated as discrete subspecies (Polziehn et al. 1998, 2000; Polziehn and Strobeck 1998, 2002) and as evolutionarily significant units. Values of F_{ST} and log-likelihood values for tests of population differentiation were highly significant. AMOVA results indicated that the subspecies are well differentiated and gene flow has likely occurred among populations within the subspecies.

The criteria used for determining which populations comprise an evolutionarily significant unit have been the topic of considerable debate (i.e.. Crandall et al. 2000; Fraser and Bematchez 2001; Moritz 1994, 2002). We incoiporated criteria from these studies and propose evolutionarily significant units for elk in California. Tule elk displayed highly significant differences in nuclear allele frequencies relative to other elk populations, consistent with the criteria of Waples (1991) and Moritz (1994, 2002). Given its unique ecological niche, evolutionarily significant unit status is warranted under the "ecological exchangeability" concept of Crandall el al. (2000).

We propose evolutionarily significant unit status for Roosevelt elk of the north coast of California (Humboldt and Del Norte counties). Again, significant genetic divergence was observed between this group and the other sampled populations. Because Roosevelt elk from the Olympic Peninsula in Washington Stale may have some Rocky Mountain introgression (Polziehn and Strobeck 2002), care (and perhaps genetic testing) is essential before translocating elk from the Olympic Peninsular to augment Roosevelt elk in other regions, including California.

Rocky Mountain elk are the least populous elk in California, although they exist in great numbers in the mountains of the western United States. They are genetically distinct from both the Roosevelt and tule elk and inhabit environments where the tule elk are absent. The only pure population of Rocky Mountain elk within California identified from this study occurs at Tejon Ranch (Kern County). These animals originally were imported from Yellowstone National Park, Wyoming. California Department of Fish and Game managers had expressed concern that these animals had bred with tule elk at I point in time; this concern appears unfounded. Rocky Mountain elk and tule elk are held al 2 physically separated ranches in Kern County. Although Rocky Mountain elk are sympatric with Roosevelt elk in northern California, their range extends beyond that of Roosevelt elk east into the Rocky Mountains. Elk taken from the counties containing hybrids should be genetically tested on an individual basis to determine the subspecies of their source. Polziehn et al. (2000) documented that population subdivision and restricted gene flow occurs in herds of Rocky Mountain elk, many of which were relocated or reintroduced. Considering that this subspecies covers a large geographic area, future studies covering larger geographic areas are likely to identify additional Rocky Mountain elk evolutionarily significant units.

To date, our study is the most comprehensive population genetic analysis of the 3 subspecies of elk inhabiting California and should provide valuable information for elk managers and wildlife law enforcement. Future conservation efforts should focus on ensuring connectivity between herds or populations within each evolutionarily significant unit to ensure that adaptive genetic variation is maintained in a large population and not removed by genetic drift or fixed by inbreeding in small isolated populations. Current population management efforts focus primarily on the protected tule elk, maintained as several distinct, isolated herds across the state. We recommend the continued translocation of tule elk between the herds in order to maintain the genetic diversity of the tule subspecies and avoid the potential inbreeding that can occur in small polygynous herds.

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Literature Cited

Banks, M. A., and W. Eichert. 2000. WHICHRUN (version 3.2): a computer program for population assignment of individuals hased on mullilocus genotype data. Journal of Heredity 91:87-89.

Brownstein, M. J., J. D. Cariten, and J. R. Smith. 1996. Modulation of non-templated nucleotide addition by Taq DNA polymerase: primer modifications that facilitate genotyping. BioTechniques 20:1004–1010.

Clutton-Brock, T. H. 1989. Mammalian mating systems. Proceed¬ings of the Royal Society of London, B. Biological Sciences 236:339-372.

Crandall, K. A., O. R. P. Bininda-Emonds, G. M. Mace, and R. K. Wayne. 2000. Considering evolutionary processes in conservation biology: returning to the original meaning of "evolutionarily significant units." Trends in Ecology and Evolution 15:290-295.

Evanno, G., S. Reqnaut, and J. Goudet. 2005. Delecting the number of clusters of individuals using the software STRUCTURE: a simulation study. Molecular Ecology 14:2611-2620.

Felsenstein, J. 1993. PHYLIP (phylogeny inference package). Version 3.5c manual. Distributed by the author, Department of Genetics, University of Washington, Seattle.

Fraser, D. J., and L. Bernatchez. 2001. Adaptive evolutionary conservation: towards a unified concept for defining conservation units. Molecular Ecology 10:2741-2752.

Guo, S., and E. Thompson. 1992. Performing the exact test of Hardy-Weinberg proportion for multiple alleles. Biometrics 48:361-372.

Hedrick, P. W. 1995. Gene flow and genetic restoration: the Florida panther as a case study. Conservation Biology 9:996-1007.

Hedrick, P. W. 1999. Perspective: highly variable loci and their interpretation in evolution and conservation. Evolution 53:313-318.

Hedrick, P. W. 2001. Conservation genetics: where are we now? Trends in Ecology and Evolution 16:629-636.

Jones, K. C., K. F, Levine, and J, D. Banks. 2000. DNA-based genetic markers in black-tailed and mule deer for forensic applications, California Fish and Game 86:115-126.

Jones, K. C,, K. F. Levine, and J. D. Banks. 2002. Characterization of eleven polymorphic tetranucleolide microsalellitcs for forensic application in California elk *(Cervus elaphus)*. Molecular Ecology Notes 2:425-427.

McCullough, D. R. 1969. The tule elk: its history, behavior, and ecology. University of California Publications in Zoology 88:1-209.

McCullough, D. R,, J. K. Fischer, and J. D. Ballou. 1996. From bottleneck to metapopulation: recovery of the tulc elk in California. Pp. 375^403 in Metnpopulations and wildlife conservalion (D. R. McCullough, ed.). Island Press, Covelo, California.

Meredith, E, P., J. A. Rodzen, K. F. Levine, and J. D. Banks. 2005. Characterization of an additional 14 microsatellite loci in California Elk *(Cervus elaphus)* for use in forensic and population applications. Conservation Genetics 6:151-153.

Merriam, C. H. 1905. A new elk from California, *Cervus nannodes.* Proceedings from Ihe Biological Society (Washington) 18:23-25.

Moritz, C. 1994. Defining "evolutionarily significant units" for conservation. Trends in Ecology and Evolution 9:373-375.

Moritz, C. 2002. Strategies to protect biological diversity and the processes that sustain it. Systematic Biology 51:238-254.

Nei, M. 1972, Genetic distance between populations. American Naturalist 106:283-292,

O'Gara, B. W. 2002. Taxonomy, Pp. 3-67 in Elk of North America: ecology and management (D. Toweill and J. Thomas, eds.). Smithsonian Institution Press, Washington, D.C.

Polziehn, R. O., *I.* Hamr, F. F. Mallory, and C. Strobeck. 1998. Phylogenetic analysis of North American wapiti (Cemw *elaphus)* subspecies. Canadian Journal of Zoology 76:998-1010.

Polziehn, R. O., J. Hamr, F. F. Mallory, and C Strobeck. 2000. Microsatellite analysis of North American wapiti *(Cervus elaphus)* populations. Molecular Ecology 9:1561-1576.

Polziehn, R. O., and C. Strobeck. 1998. Phylogeny of wapiti, red deer, sika deer, and other North American cervids as determined from mitochondrial DNA. Molecular Phylogenetics and Evolution 10:249-258.

Poi^iehn, R. O., and C. Strobeck. 2002. A phylogenetic comparison of red deer and wapiti using mitochondrial DNA. Molecular Phylogenetics and Evolution 22:342-356.

Pritchard, J. K., M. Stephens, and P. Donnelly. 2000. Inference of population structure from multilocus genotype data. Genetics 155:945-959.

Raymond, M., and F. Rousset. 1995. GENEPOP (version 1.2): population genetics software for exact tests and ecumenicism. Journal of Heredity 86:248-249.

Reneau, J., and S. C. Reneau, 1993, Records of North American big game. Boone and Crockett Club, Missoula, Montana.

Schneider, S., D. Roessli, and L. Excoffier. 2000. Arlequin ver¬sion 2.000; a software for population genetics data analysis. Ge¬netics and Biometry Laboratory, University of Geneva, Geneva, Switzerland.

Waples, R. S. 1991. Pacific salmon, *Oncorynchus* spp., and the definition of "species" under the endangered species act. Marine Fisheries Review 53:11-22.

Weir, B, S,, and C, C. Cockerham. 1984. Estimating F-statistics for the analysis of population structure. Evolution 38:1358-1370.

Williams, C. L., B. Lundrigan, and O. E. Rhodes. 2004. Micro-satellite variation in tule elk. Journal of Wildlife Management 68:109-119.

Williams, C. L., T. L. Serfass, R. Cogan, and O. E. Rhodes. 2002. Microsatellite variation in the reintroduced Pennsylvania elk herd. Molecular Ecology 11:1299-1310.

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Phylogenetic status of North American wapiti *(Cervus elaphus)* subspecies

R.O. Polziehn, J. Hamr, F.F. Mallory, and C. Strobeck

Abstract: By the turn of the century, North American elk, or wapiti *(Cervus elaphus),* had been extirpated from all regions of the continent and two subspecies were extinct. The recovery of wapiti is largely a response to the large number of relocated Rocky Mountain *(C. e. nelsoni)* and Manitoban wapiti *(C. e. manitobensis).* A phylogenetic study was performed to determine the present genetic relationships among tule (C. *e. nannodes)* Roosevelt *(C. e. roosevelti),* Rocky Mountain, and Manitoban subspecies, using sequences from the D-loop region of the mitochondrial DNA of 28 individuals. All Roosevelt wapiti were grouped together, as were tule wapiti, which supports the classification of tule and Roosevelt subspecies. Yellowstone, Elk Island, and Riding Mountain National Porks have not introduced wapiti into their indigenous populations. When these populations were used, Manitoban wapiti were found to be monophyletic and Rocky Mountain wapiti to be paraphyletic. However, including animals from the Canadian Rocky Mountains places Rocky Mountain wapiti in clades by themselves or grouped with Manitoban wapiti. The clade containing a mixture of Manitoban and Rocky Mountain wapiti suggests that both types recently descended from a common ancestor. Hybridization or insufficient time for separation may explain the presence of the two types in the same clade.

R6sum6 : Ddja au toumant du slide, le Grand Cerf nord-amdricain, ou Wapiti *(Cervus elaphus),* avait dtd extermine de toutes les regions du continent et deux sous-espices etaient ddjh disparues. La remontie du wapiti est en grande partie le risultat de la relocalisation d'un grand nombre d'animaux des stocks des Montagnes rocheuses *(C. e. nelsoni)* et du Manitoba (C. *e. manitobensis).* Une etude phylogenetique a dtd entreprise pour determiner les relations gendtiques actuellcs entre les sous-esp^ces de tule (C. *e. nannodes),* de Roosevelt (C. *e. roosevelti),* des Montagnes Rocheuses et du Manitoba, d'aprds les séquences de la boucle D de l'ADN mitochondrial de 28 individus. Tous les Wapitis de Roosevelt ont de regroupćs et tous les Wapitis de tule ont formé un autre groupe, ce qui conflrme la validity des deux sous-espbees de tule et de Roosevelt, 11 n'y a pas eu d'introduction de wapitis dans les populations indigenes des pares nationaux de Yellowstone, Elk Island et Riding Mountain. L'dtude de ces populations a permis d'dablir que les populations de wapitis du Manitoba sont monophyletiques et que celles des wapitis des Montagnes Rocheuses sont paraphyletiques. Cependant, I'intdgration de wapitis des Rocheuses canadiennes dans les analyses place les wapitis des Montagnes Rocheuses dans des clades Isolds, ou regroupis avec des wapitis du Manitoba. Le clade qui contient un melange de wapitis du Manitoba et des Montagnes Rocheuses reflate probablemcnt Involution rdcenle des deux types 4 partir d'un ancêtre commun. La presence des deux types dans le mime clade pent Stre attribuable d l'hybridation ou au fait que le laps de temps icouli depuis la separation des deux taxons est encore insuffisant. [Traduit par la Redaction]

Introduction

Herds of North American elk *(Cervus elaphus),* also known as wapiti, recently inhabited nearly evety region of North America, Wapiti populations were tenuously classified into six subspecies that corresponded to their biogeographical dis¬tribution and ecozones (Bryant and Maser 1982), The classifi¬cation of wapiti has been examined using morphology, behavior, and, more recently, molecular characteristics (Bry¬ant and Maser 1982; Cronin 1992). However, little consen¬sus exists regarding subspecies distinctions. Determining evolutionary relationships among taxa can assist in the con¬servation and management of species. Populations that have been historically isolated and are likely to possess a unique evolutionary potential are called evolutionarily significant units (ESU; Moritz 1994). ESUs should be monophyletic for mitochondrial DNA (mtDNA) and show significant diver¬gence of allele frequencies at nuclear loci (Moritz 1994). In this phylogenetic study, mtDNA was employed to determine the validity of North American wapiti subspecies.

Presently, six subspecies of wapiti are recognized in North America, including the extant Manitoban (C. *e. manito¬bensis* Millais, 1915), Rocky Mountain (C. *e. nelsoni* Bailey, 1935), Roosevelt (C. *e, roosevelti* Merriam, 1897), and tule wapiti (C. *e. nannodes* Merriam, 1905) and the extinct eastern (C. e. *canadensis* Erxleben, 1777) and Merriam (C. *e. merriami* Nelson, 1902) wapiti. Earlier classifications of wapiti, however, considered North American animals to be

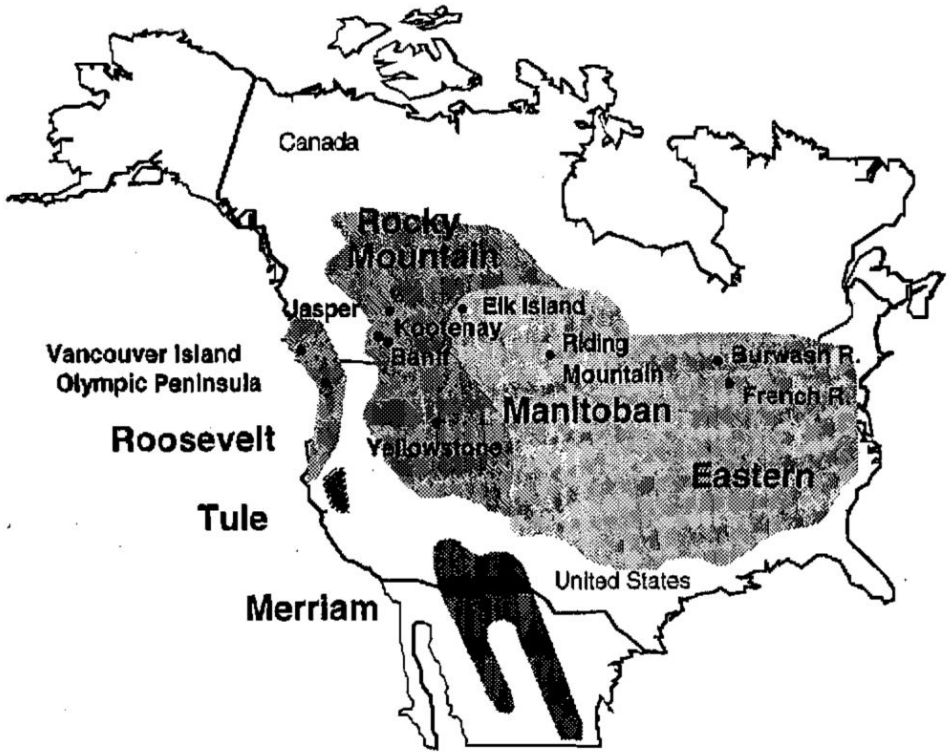
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R.O. Polziehn[1] and C. Strobeck. Department of Biological Sci¬ences, University of Alberta, Edmonton, AB T6G 2E9, Canada.
J. Hamr. Northern Environmental Heritage Institute, Cambrian College, Sudbury, ON P3A 3V8, Canada.
F.F. Mallory. Department ofBiology, Laurcntian University, Sudbury, ON P3E 2C6, Canada.

[1] Author to whom all correspondence should be addressed (e-mail: rpolzieh@gpu.srv.ualberta.ca).

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Fig. 1. Historical ranges of the Roosevelt, Rocky Mountain, Manitoban, eastern, Merriam, and tule wapiti, adapted from Bryant and Maser (1982). The locations of each of the four extant and one extinct subspecies in the sample used in this study are identified.



distinct from the European red deer and also had fewer divisions. This is demonstrated by Murie (1951), who accepted only two species of North American wapiti: *C. canadensis* and *C. nannodes*. The name *C. e. canadensis* was used to describe the eastern, Rocky Mountain, Manitoban, and even the Roosevelt wapiti (Bryant and Maser 1982). Currently, subspecies found in adjoining ranges are still considered by some to be one entity. Schonewald (1994) suggested that the extinct Merriam wapiti was an extension of the Rocky Mountain type.

Postglacial distributions of the various forms of wapiti (see Fig. 1) have been discussed by Geist (1971), Banfield (1974), Bryant and Maser (1982), and Peek (1982). Historically, the Rocky Mountain wapiti range followed the Rocky Mountains and extended across the northern Canadian boreal coniferous forest. The Manitoban wapiti range covered the region of the prairies known as the Great Plains. The eastern wapiti range corresponded to the eastern deciduous forests that lay parallel to the Manitoban wapiti range and the Atlantic coast, with a northern limit at the Great Lakes and a southern limit in northern Florida. The Merriam wapiti range was south of the Rocky Mountain wapiti range and covered the states of Arizona, Texas, New Mexico, and Mexico. The Roosevelt wapiti range extended along the west coast from southern British Columbia to northern California, while the tule wapiti range was enclosed by the Sierra Nevada – Cascade Mountains in southern and central California (Bryant and Maser 1982).

Hunting and ranching activities led to the extirpation of wapiti from most of their native ranges, and by 1900 only a few herds were found in North America. The tule animals (reports range from one pair to 100) were salvaged by Henry Miller during the mid-1870s and given refuge on his ranch in California (Bryant and Maser 1982). The Merriam wapiti is thought to have become extinct at the start of the 1900s, and the last eastern wapiti was seen in 1893 near North Bay, Ontario (Bryant and Maser 1982). Small herds of Roosevelt wapiti survived on Vancouver Island, British Columbia, on the Olympic Peninsula in Washington State, and in the Cascade Mountains of Oregon.

The difficult terrain in British Columbia provided refuge for several (10-20) isolated herds of Rocky Mountain wapiti (Spalding 1992). In Alberta, these wapiti were reduced to a few dozen in the Brazeau and Highwood river drainages and approximately 150-300 in the Oldman River drainage (Bryant and Maser 1982). Wapiti were never common in the valleys of Jasper and Banff National Parks (Kay et al. 1994). Legislated protection and inhospitable terrain also contributed to the survival of Rocky Mountain wapiti in Colorado, Montana, and Wyoming. The largest herd (>1000 animals) to survive the great extirpation was found in Yellowstone National Park (Houston 1974).

Manitoban wapiti, abundant throughout Alberta until 1810, were reduced to 24 animals in Elk Island National Park by 1906 (Blyth and Hudson),[2] and an unknown number of animals are thought to have existed in the Cypress Hills. Few

[2] C. Blyth and R. Hudson. Vegetation and ungulate management plan for Elk Island National Park. Unpublished status review, Department of Animal Science, University of Alberta, Edmonton, pp. 117-131.

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animals survived on the open prairies and no Manitoban wapiti were found in the United States after 1900. The largest concentration of Manitoban wapiti was found in Riding Mountain National Park, Manitoba, which began with more than 500 animals (Banfield 1949).

The similarity in appearance of wapiti in the different ranges led to questions regarding their taxonomic status. However, morphological comparisons failed to reveal unique or indisputable characters that can discriminate between the different subspecies. Skull and antler characters both separated subspecies (McCullough 1969; Hutton 1972) and lumped them together (Green 1956; Blood and Lovaas 1966; Hutton 1972). Manitoban wapiti were described as both smaller (Soper 1946) and larger (Blood and Lovaas 1966) than Rocky Mountain wapiti. However, there is little dispute that the tule form is both smaller and lighter in coat color than other forms. As well, the Roosevelt form tends to be larger and heavier than the .Rocky Mountain form, with more massive but shorter (crownlike) antlers, a shorter tail, longer hind feet, and a greater contrast between light and dark portions of the coat (Schwartz and Mitchell 1945; Quimby and Johnson 1951).

Morphological characters are encoded by the genetic components of DNA, but are influenced by the age, sex, and health of an animal, as well as by seasonal and habitat conditions (Berger and Peacock 1988; McHugh 1972; Geist 1991), Comparisons of strictly genetic components avoid these complex influences and still allow one to use characters that are under evolutionary constraints. Few studies have been directed at identifying the diversity of wapiti. Chromosome numbers vary within the genus *Cervus* (Fontana and Rubini 1990), but are constant among North American wapiti subspecies. Hemoglobin (Dratch 1986) and protein electrophoresis studies (Dratch and Gyllensten 1985) identified loci that were both unique and fixed in either red deer or wapiti, but they did not separate North American animals into subspecies. Glenn and Smith (1993) failed to differentiate among five of seven Rocky Mountain populations by means of protein variation. They did note that the number of polymorphic loci (P) was 0.087 in wapiti, with an average of 1.1 allele per locus, and that there was a slight difference between Roosevelt and Rocky Mountain populations. A lack of variation was also observed by Cameron and Vyse (1978), who found a *P* value of 0.0416 for wapiti in Yellowstone National Park, and Kucera (1991), who obtained a *P* value of 0.053 for tule wapiti. Random amplified polymorphic DNA analysis of wapiti suggested that similarity among individuals ranged from 0.976 to 0.947 (Comincini et al. 1996).

Clearly, genetic variation exists in wapiti populations, albeit reduced. DNA that has highly evolving sequences, such as the D-loop region of mtDNA, will usually produce more variable characters and is therefore best suited for distinguishing between closely related taxa. Total mtDNA analysis using restriction enzymes failed to uncover unique differences between 22 wapiti (Cronin 1991). While restriction analysis can assay at most a few hundred nucleotides, sequencing can assay thousands. In a study to determine genetic variation among subspecies, Cronin (1992) found one unique haplotype in the Rocky Mountain population. In addition to a common haplotype found among Rocky Mountain and Manitoban animals, restriction analysis of the D-loop region of mtDNA from 59 wapiti by Polziehn (1993) and Murray et al. (1995) confirmed a unique *CftA* restriction pattern for 15.8% (3/19) Rocky Mountain wapiti and a /fmfl restriction site for all 25 Roosevelt wapiti.

The relationship between genetic and geographic distribution has been used to augment classical taxonomy. However, employing genetic diversity to identity wapiti subspecies and their ranges has been complicated by numerous relocations of animals. Transplanting wapiti throughout North America gained popularity when populations started flourishing in Yellowstone, Olympic Peninsula, Elk Island, and Riding Mountain National Parks and on private land in California. Relocations of significance to this study are listed in Fig. 2. Many past introductions have involved moving wapiti from one subspecies into the range of another subspecies, and remarkably, similar events still occur. In 1984, for example, a group of Manitoban wapiti were released in the Kechikan River Valley, home of a native herd in coastal British Columbia.

A phylogenetic analysis of the D-loop region of mtDNA was performed to investigate genetic variability among wapiti and to determine if the genetic relationships correspond to the distribution of subspecies. When all descendants of the most recent common ancestor were found to belong to one subspecies, the subspecies is called monophyletic. Monophyletic groups provide strong support for subspecific status. Paraphyly occurs when not all members of the most recent common ancestor are found in one subspecies. Paraphyly can occur among well-defined subspecies. Subspecies that arose from several recent common ancestors or lineages are called polyphyletic. Polyphyly is usually apparent when there has been insufficient time for populations to become distinct, or occurs as a consequence of hybridization or relocation. Polyphyly of subspecies provides evidence against the biological reality of such groups.

Materials and methods

Collection

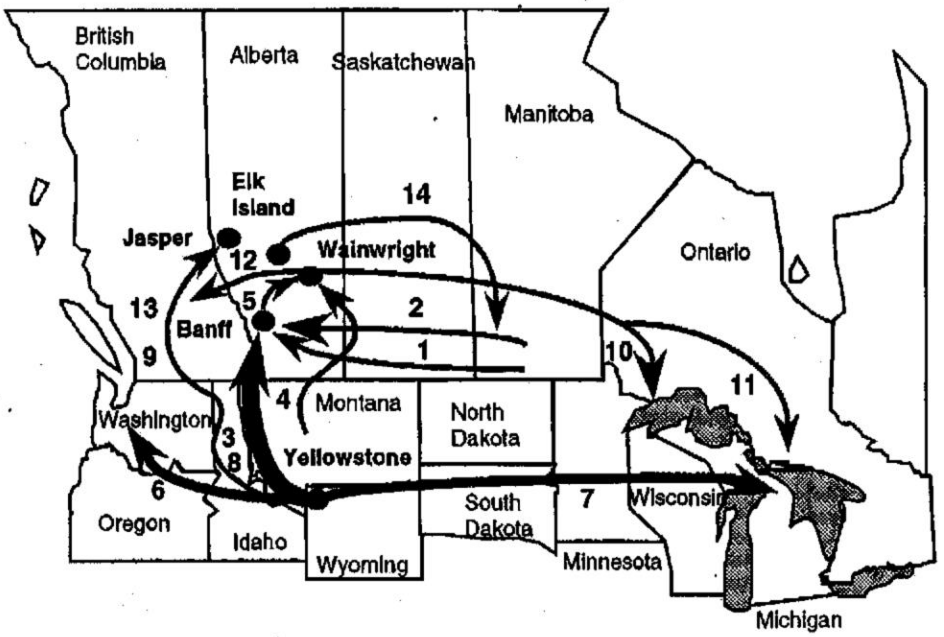
Samples representing Rocky Mountain wapiti were collected opportunistically from the following National Parks: Jasper, Alberta (91 and 92); Banff, Alberta (23, 37, and 14); Kootenay (KNP), B.C., and Yellowstone, Wyoming (1 and 2). Samples from Manitoban wapiti were collected from animals restrained for transport from Elk Island National Park, Alberta, and opportunistically from animals from Riding Mountain National Park, Manitoba. Samples potentially representing eastern wapiti were also collected from the French (B5A and B6) and Burwash (T1 and T5(55) river regions south of Sudbury, Ontario. Roosevelt samples (Roosevelt 33, 32, 29, 25, and 23) were supplied by the Fish and Wildlife Services in Alberta and British Columbia. The Forensics Laboratory of U;S. Fish and Wildlife supplied lyophilized samples from sika deer (215 and 226 samples), red deer (765 and 923 samples), tule wapiti (457 and 659), and Roosevelt wapiti (10 samples), The locations of samples from Canada and the United States are shown in Fig. 1.

Isolation and amplification (polymerase chain reaction)

DNA was isolated as in Bork et al. (1991) or using methods described in the Qiagen QIAamp tissue isolation kit (Chatsworth, Calif.). The D-loop region of mtDNA was enzymatically amplified in 190 pL of reaction mixture containing 0.06 mM each of dATP, dCTP, dGTP, and dTTP, 1X polymerase chain reaction (PCR) buffer (10 mM Tris buffer, pH 8.8, 0.1% Triton X 100, 50 mM KC1, and 0.16mg/mL

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Fig. 2. Relocations of wapiti in North America (Lloyd 1927; Bryant and Maser 1982; Stelfox and Stelfox 1993). Only a few of the hundreds of introductions that have taken place since 1900 are shown. These transfers illustrate the potential for hybridization to take place between subspecies.



Event No.	Dats	Description
1	1900	Banff National Park received four bulls and one cow from Mrs. Ticknor of Morden, Manitoba.
2	1902	Banff National Park received one cow from Portage la Prairie, Manitoba (and one cow from Calgary, Alta.)
3	1910	Banff National Park purchased two cows and two bulls originating from Wyoming from Mr. J. Hill
4	1910	Wainwright Buffalo Park purchased two bulls and one cow from Michele Pablo of Montana
5	1910	Wainwright Buffalo Park received six wapiti from Banff National Park
6	1913	Yellowstone National Park shipped animals for 20 years into the Selkirk and Wenatchee Mountains
7	1915	Yellowstone National Park introduced 23 animals to Sturgeon County, Michigan
8	1916	Yellowstone National Park shipped 66 wapiti to Banff National Park and another 196 in 1920
9	1920	98 Yellowstone National Park wapiti were introduced into Jasper National Park
10	1930s	24 wapiti from Wainwright Buffalo Park were introduced to the Burwash Industrial Prison farm near Sudbury, Ont.
11	1920-1940	Wainwright Buffalo Park sent wapiti to the Niplgon-Onamon Game Preserve and an enclosure near Pemberton, Ont. Animals from the enclosure were relocated to the Bruce Peninsula, Abitibi, Peterborough, and Marten River
12	1927	Wainwright Buffalo Park shipped 25 wapiti to Cookson, B.C.; in 1933 another 25 animals went to Adams Lake, B.C.
13	1936	Yellowstone National Park wapiti shipped to Hinton, Alta., near Jasper National Park
14	1949	Elk Island National Park shipped an unknown number of animals to The Pas, Man.

bovine serutn aibumln), 1 unit of *Taq* polymerase, 2.0 mM magnesium chloride, and 20 pmol each of primers CST 2 and 39 (Table 1). Primer CST 2 anneals to the start of the transfer RNA (tRNA) proline gene upstream from the D-loop region and CST 39 anneals to the start of the 128 gene downstream from the tRNA phenylalanine gene and D-loop region. These primera were based on universal D-loop primers described by Kocher et al. (1989). Each 100-pL amplification reaction was performed on a 9600 Perkin Elmer Cetus thermocycler, using the following conditions: a 3-min denaturing step at 94°C; 30 cycles at 94°C for 15 s, 56°C for 30 s, and 72°C for 30 s; and a final 10-min extension at 72°C. The amplified products were separated from unincorporated primers by electrophoresis on a 1% agarose 0.5 X TBE gel. DNA fragments containing the D-loop region were excised from the gel with a scalpel and the DNA was isolated using a Qiagen Qiaquick Extraction kit. Samples were desiccated and resuspended in 36 p.L of double-distilled water.

Each sequencing reaction of the D-loop region was performed using 8 pL of purified PCR product, as described in the Perkin-Elmer Dye Terminator Cycle Sequencing Ready Reaction kit. Primers used for sequencing are given in Table 1. Cycle sequencing reaction parameters on the 9600 Perkin Elmer Cetus thermocycler were denaturation at 96°C for 15 s, annealing at 50°C for I s, and extension at 60°C for 4 min. Sequencing reactions were separated by electrophoresis on a ABI Prism 377 Perkin Elmer automated sequencer. Sequence data were processed and analyzed using ABI sequence software.

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Table 1. Primers employed in the sequencing of the control region of mitochondrial DNA in cervids.

Primer	Location	Sequence (5'–3')
2*	1-22	TAATATACTGGTCTTGTAAACC
25*	614-591	TCATGGGCCGGAGCGAGAAGAGG
39*	1216-1192	GGGTCGGAAGGCTGGGACCAAACC
139*	493.-522	ATGTCAAATCTACCCTTGGCAACATGCGTA
149*	763-730	AGCACAGTTATGTGAGCATGGGCTGATTGG
463	714-733	CTCGATGGACTAATGACTAA
464	275-294	CTCGTAGTACATAAAATCAA
463	990-953	ATAAGGGGGAAAAATAAGAA

♦Published in Polziehn (1993).

PCR products from the 10 Roosevelt samples from Olympic Peninsula National Park were restricted with the endonuclease *HinfL* It was thought that this enzyme distinguished Roosevelt wapiti from other wapiti subspecies in the D-loop region of mtDNA. The fragments were separated by electrophoresis on a vertical gel apparatus as described by Murray et al. (1995).

Phylogenetic analysis

Once sequences were aligned using the software Sequence Editor™ (Applied Biosystems), nucleotide substitutions, deletions, and insertions were identified. Sequences were analyzed for phylogenetic content using the heuristic branch-and-bound option of PAUP 3.1 (Swofford 1993). The PAUP program constructs phylogenetic trees based on parsimony criteria. Trees were constructed using both unweighted and weighted characters, where transversions were worth 2, 5, and 10 times more than transitions and gaps were equally weighted to transitions. Gaps generally occurred in tandom repeats of a single nucleotide. Trees were rooted using red deer and sika deer and examined for polyphyly. Bootstrapping was used to place confidence estimates on branches within the most parsimonious trees and was restricted to 100 replicates. Trees were constructed for pure populations as well as for populations known to have introductions.

Divergence

The following estimates of DNA divergence are taken from Nei (1987). The average number of nucleotide substitutions for haplotypes *(dx)* in population *X* are estimated by

$$d_x = \frac{n_X}{n_x - 1} \sum_{ij} x_i x_j d_{ij}$$

where n_X is the number of sequences sampled and d_{ij} is foe number of nucleotide substitutions per site between the ith arid Jth haplotypes, The average number $(d^{\wedge})$ of nucleotide substitutions between DNA haplotype from populations *X* and T is estimated from

$$d_{XY} = hij^{\wedge}yjdy$$

where d_{ij} is the number of substitutions between the rth haplotype from *X* and the yfo haplotype from K The number of net nucleotide substitutions can be estimated by substracting foe average intrapopulation distance from the inlrapopulation distance, given as

$$7t = dxf - (dx + d_Y)/2$$

Results

The D-loop region of mitochondrial DNA amplified from the four subspecies of North American wapiti was 1211 base pairs (bp) compared with 1135 bp for the red deer and 1215 bp for the sika deer. Compared with the North American wapiti, the red deer had four insertions and three deletions, with one deletion of 77 bp (Table 2). The sika deer had four insertions relative to the North American wapiti.

In addition to 2 red deer and 2 sika deer sequences, 25 unique sequences were recognized from the 28 wapiti analyzed. The sequences submitted to GenBank have Accession Numbers AF005196-5200, AF016953-16977, and AF016979-16980. In the phylogenetic analysis, there were 40 variable nucleotide sites among the wapiti sequences (Table 3), including 27 transitions, 9 tranversions, 2 insertions, and 2 deletions. There were 17 uninformative sites (113, 315, 476, 541, 681, 709, 798, 838, 852, 935, 942, 951, 986, 1025, 1054, 1117, and 1138) and 23 informative sites (181, 269, 440, 442, 444, 448, 450, 487, 488, 493, 627, 679, 694, 703, 717, 737, 808, 867, 960, 968, 981, 988, and 1154). Sites 440, 442, 448, 487, 488, 627, 679, 694, and 703 were homoplasic between wapiti and the out-groups, and characters 181, 450, 486 or 968, 960, and 988 were homoplasic within wapiti. Characters at sites 181, 960, 968, and 981 represent the absence/presence of a nucleotide in a long repeat of the identical nucleotide. Similarly, nucleotide substitutions found within a string of repeats include characters at sites 694, 709, 867, 951, and 1154. Replication errors are more likely to occur at runs of identical bases in the DNA (Ghosal and Saedler 1978), therefore mutations at these sites carry little phylogenetic weight.

The sequence of Yellowstone National Park wapiti (2) matched that of the KNP wapiti, Riding Mountain National Park sample 3 matched Riding Mountain National Park sample 4, and Burwash River sample T1 matched Burwash River sample T5(55). Because mtDNA is passed maternally, animals sharing female founders will have the same mtDNA sequences. The Riding Mountain National Park samples 3 and 4 were from the same herd, and similarly, Burwash River samples T1 and T5(55) were from the same herd. The KNP wapiti most likely descended from a Yellowstone animal relocated to Banff in the 1920s.

The number of nucleotides that varied between sequences ranged from 2 to 14 among Rocky Mountain and Manitoban animals, from 3 to 13 among Rocky Mountain and Roosevelt animals, and from 4 to 15 among Rocky Mountain and tide animals, with an average of 0.56% (6.53/1165) nucleotide

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Table 2. Control region sequences from mlDNA of North American wapiti, Asian sika deer, and European red deer.

```
                                                                                                    60
Wapiti      TAATATACTG  GTCTTGTAAA  CCAGAAAAGG  AGAGCAACCA  ACCTCCCTAA  GACTCAAGGA
Sika deer   ..........  ..........  ..........  ..........  ..........  ..........
Red deer    ..........  ..........  ..........  .......T..  ..........  ..........
                                                                                                   120
Wapiti      AGAAGCCATA  GCCCCACTAT  CAACACCCAA  AGCTGAAGTT  CTATTTAAAC  TATTCCCTGA
Sika deer   ..........  ..........  ..........  ..........  ..........  ..........
Red deer    T.........  ..........  ..........  ..........  ..........  ..........
                                                                                                   180
Wapiti      CGCTTATTAA  TATAGTTCCA  TAAAAATCAA  GAACTTTATC  AGTATTAAAT  TTCCAAAAAA
Sika deer   ..........  ..........  ..........  ..........  ..........  ..........
Red deer    ..........  ..........  .........A  ..........  ..........  .........G
                                                                                                   240
Wapiti      -TTTAATATT  TTAATACAGC  TTTCTACTCA  ACATCCAATT  TACATTTTAT  GTCCTACTAA
Sika deer   T.........  ..........  ..........  ...C......  ......C...  .C....T...
Red deer    T.........  .C........  ....C.....  ...C..T...  .........C  A.....-...C..
                                                                                                   300
Wapiti      TTACACAGCA  AAACACGTGA  TATAACCTTA  TGCGCTCGTA  GTACATAAAA  TCAATGTGCT
Sika deer   CC.....A..  ..G.......  ..........  ...T...T...  ..........  .T....CATC
Red deer    .......A..  ...T.T..A.  ......TA..  ......TA..  .......G..  .1....A...
                                                                                                   360
Wapiri      AGGACATGC-  ATGTATAACA  GTACATGAGT  TAGCG-TATA  GGACATATTA  TGTATAATAG
Sika deer   .A.....A.T  .....CGGT.  .........AA  CC.GTA....  .......C..  ..........
Red deer    .......A.T  ..........  ......----  ----------  ----------  ----------
                                                                                                   420
Wapiti      TACATAAATT  AATGTATTAA  GACATATTAT  GTATAATAGT  ACATTATATT  ATATGCCCCA
Sika deer   ..........  .........G  A.........  ..........  ..........  ..........
Red deer    ----------  ----------  ----------  ----------  ----------  ..........
                                                                                                   480
Wapiti      TGCTTATAAG  CATGTACTTC  TCACTATCTG  AAGTACATAG  TACATAATGT  TGTTCATCGT
Sika deer   ..........  ......T..T  CT.T.....A  T.........  .....G....  CA..T.....
Red deer    ..A.......  .........T  CT.T...T.A  T.........  .....G....  ..........
                                                                                                   540
Wapiti      ACATAGTACA  TTAAGTCAAA  TCAGTCCTTG  TCAACATGC   GTATCCCGTCC  CCTAGATCAC
Sika deer   .......C...  ..........  ..........  ..........  ..........  ..........
Red deer    ......CG..  ..........  ..........  ..........  ..........  ..........
                                                                                                   600
Wapiri      GAGCTTAATT  ACCATGCCGC  GTGAAACCAG  CAACCCGCTG  GGCAGGGATC  CCTCTTCTCG
Sika deer   ......G...  ..........  ..........  .........A  ..........  ..........
Red deer    ......G...  ..........  ..........  ..........  ..........  ..........
                                                                                                   663
Wapiti      CTCCGGGCCC  ATGAACCGTG  GGGGTAGCTA  TTTAATGAAT  tttatcagac  ATCTGGTTCT
Sika deer   ..........  ..........  ......A...  .........C  ..........  ..........
Red deer    ..........  ......T...  ..........  .........C  ..........  ..........
                                                                                                   720
Wapiti      TTTTTCAGGG  CCATCTCATC  TAAAATCGCC  CACTCCTTGT  AAC-ATAAGA  CATCTCGATG
Sika deer   ..........  ........C.  ..........  .........C  ..TT.C....  ..........
Red deer    ..........  ........C.  ..........  .........C  ..T.......  ..........
                                                                                                   780
Wapiti      GACTAATGAC  TAATCAGCCC  ATGCTCACAC  ATAACTGTGG  TGTCATACAT  TTGGTATTTT
Sika deer   ..........  ..........  ..........  ..........  ..........  ..........
Red deer    ..........  ..........  ..........  ..........  ..........  ..........
                                                                                                   840
Wapiti      TAATTTTTGG  GGGGATGCTT  GGACTCAGCA  ATGGCCGTCT  GA-GGCCCCG  TCCCGGAGCA
Sika deer   ----------  ..........  ..........  ..........  ..........  ..........
Red deer    ..........  ..........  ..........  ..A.......  .GC..T....  ----------
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Table 2. *(concluded)*

		*	*				909
Wapiti	tgaattgtag	CTGGACTTAA	CTGCATCTTG	AGCATCCCCA	TAATGGTAGG	CGCAGGGCAT	
Sika deer	....	....	....	....	....	ATG.....	
Red deer	....	....	....	....	....	AT-.....	
				*	* *	*	960
Wapiti	TACAGTCAAT	GGTCACAGGA	CATAGTTATT	ATTTCATGAG	TCAACCCTAA	GATCTATTTT	
Sika deer	,G.....	....	....	....	....	....	
Red deer	GG.....	.....	..,.A.C...	....	....	....	
	*		* * *				1020
Wapiti	CCCCCCCCTT	CTTATTTTTT	-CCCCCTTAT	ATAGTTATCA	CCATTTTTAA	CACACTTTCC	
Sika deer	....	.....«..	.....».«	.....C..	T.....	.....T.	
Red deer	.....G	..A.....	....	....	....	.....T.	
	*			*			1080
Wapiti	CCTAGATATA	ATTTTAAATT	TATCACATTT	CCAATACTCA	AAATAGCACT	CCAGAGGGAG	
Sika deer	.....T	....	....	....	..T.....	....	
Red deer	.....T	....	....	....	..TC.....	....G...T.	
				*		*	1140
Wapiti	GTAAGTATAT	AAACGCCAAT	TTTTCCCTAA	TTATGCATAG	TTAATGTAGC	TTAAACAGCA	
Sika deer	....	....	....	....	....	....	
Red deer	...,C.....	....	....	.....T.C..	.,G.....	.....TG...	
		*					1209
Wapiti	AAGCAAGGCA	CTGAAAATGC	CTAGATGAGT	ATATTAACTC	CATAAAACAC	ATAGGTTTGG	
Sika deer	....	....	....	....	....	....	
Red deer	....	....	....	....	....	....	

Wapiti	TCCCAGCCTT	CCGACCC
Sika deer	....	.....
Red deer	....	.....

Note: Nucleotide substitutions are given and gaps are indicated by a dash. Nucleotide substitutions in wapiti are marked above the consensus by an asterisk and can be found in Table 4.

substitutions between wapiti. As estimated from sequence divergence, Manitoban and Rocky Mountain wapiti had the closest genetic distance (n), 0.00767, followed by Rocky Mountain and tule wapiti, where n = 0.00826. The greatest distances were found between tule and Manitoban wapiti, where n = 0.01256, and tule and Roosevelt wapiti, where n = 0.01288. The comparison of the numbers of nucleotide differences among subspecies places Rocky Mountain wapiti central to all other subspecies (Table 4).

Comparisons of nucleotide substitutions (Table 3) in tule wapiti revealed that site 269 was unique to tule wapiti, site 627 was shared with sika deer, and site 703 was shared with both red deer and sika deer. Comparisons of nucleotide substitutions in Roosevelt wapiti showed that site 493 was unique to all members of this group, site 1154 was unique to most of the Roosevelt wapiti, and site 450 was shared among several Roosevelt and Rocky Mountain wapiti. No informative nucleotide sites were shared by all Rocky Mountain or Manitoban wapiti, although the insertion at site 981 and deletion at site 960 were exclusive to several Manitoban wapiti. Nucleotide substitutions at sites 487 and 968 were found among both Rocky Mountain and Manitoban wapiti. The nucleotide change at site 488 created a unique recognition site for endonuclease *Cfol* among several Rocky Mountain wapiti. The nucleotide substitution at site 493 identified the unique recognition site for *Hin*^. found in Roosevelt wapiti.

Trees were constructed using weighted and nonweighted characters and both including and excluding gaps. Roosevelt and tule wapiti were found in monophyletic clades regardless of constraints or weights. If gaps were not considered informative and transversions were not given extra weight, then both Manitoban and Rocky Mountain animals were found to be paraphyletic. By including gaps as a new state character but no extra weighting on transversions, the heuristic search placed Rocky Mountain animals into clades that (z) branch before all other animals (Yellowstone 1, Banff 23, Banff 37, and Jasper 91), *(ii)* include Manitoban animals (Banff 14 and Jasper 92), and *(in)* form a sister-clade to tule and Roosevelt animals. This would make the Rocky Mountain group polyphyletic, while the Manitoban group would remain paraphyletic. Weighting transversions twice as heavily as transitions, and including gaps as characters, also resulted in paraphyly of Manitoban and polyphyly of Rocky Mountain types (see Fig. 3a). Weighting transversions to transitions more strongly (5:1 or 10:1) and counting gaps caused some interesting changes: Elk Island animals 20 and 72 grouped closely with the Yellowstone 1 animal in a clade that also included Riding Mountain National Park individuals; Yellowstone 2 and KNP animals moved to a clade containing both tule and Roosevelt animals. Banff 14 and Jasper 92 animals again grouped with the remaining Riding Mountain and Burwash River animals, and Banff 23, Banff 37, and Jasper 91 animals

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branched early in the tree. Both Manitoban and Rocky Mountain groups became polyphyletic with increasing weights on transversions.

The consensus of 26 equally parsimonious trees, using transversions weighted twice as much as transitions, and gaps equal to new state characters (shown in Fig. 3), illustrates the relationships observed among wapiti common to most trees of weighted and nonweighted characters. The consistency index was 0.928 and branch lengths were equal to 262 steps. It is important to note that the Yellowstone 2 / KNP animal can be moved to the clade containing the Manitoban wapiti without additional steps by changing the order in which characters 968 and 487 appear in the tree. Branch lengths varied between 230 and 562 for bootstraps on unweighted trees that saved only one tree per replication. Bootstraps for 100 replications were performed using the ratio 2:1 for transversions to transitions found in wapiti where branch lengths varied from 230 to 562 steps. The bootstrap (not shown) used 280 steps, and CI = 0.821. Roosevelt wapiti were grouped together with 56% frequency in the weighted bootstrap consensus tree. Rocky Mountain wapiti from Jasper, Kootenay, Yellowstone, and Banff 14 and the Manitoban sample Riding Mountain 1 also did not sort into any one clade. The number of homoplasies and the absence of unique informative characters do not lead to a consistent division of Rocky Mountain or Manitoban wapiti into subspecies.

Analysis of populations that have had no introductions, including those from Elk Island, Riding Mountain, and Yellowstone National Parks, was also performed using the same restraints as noted above. Rocky Mountain wapiti were paraphyletic and Manitoban, tule, and Roosevelt wapiti were monophyletic (Fig. 35) if Elk Island animals are of the Manitoban type.

Digests of the 10 Olympic Peninsula National Park Roosevelt samples using the restriction enzyme *Hinf*I revealed six individuals with fragment sizes of approximately 450, 340, 300, and 135 bp and four individuals with fragment sizes of 750, 340, and 135 bp. The first restriction fragment length pattern was formerly found among only Roosevelt individuals, while the second was common to Rocky Mountain and Manitoban forms. *Hinf*I sites can be found at sequence sites 493, 809, 906, and 1148.

Discussion

Historically, North American wapiti populations were assigned to subspecies largely on the basis of their geographic distribution, which has made the taxonomic classification particularly suspect for Rocky Mountain, Manitoban, eastern, and Merriam wapiti. The phylogenetic relationships of wapiti in this study are discussed with regard to the invasion and distribution of wapiti in North America and the large number of reintroductions of animals into both historical and nonhistorical ranges.

Wapiti originated in Asia and entered North America by crossing the Bering land bridge (Guthrie 1966). The land bridge between the two continents is thought to have disappeared 10 000- 15 000 years ago when the sea level rose (Pielou 1991). The post-Wisconsin stage (10 000- present) was marked by gradual climate and habitat changes that may have led to the extinction of the Alaskan population, the division of the large central population into montane/boreal, prairie, and deciduous forest ecotypes, and further isolation of the Californian and west coast populations by the Cascade and Rocky mountains (Guthrie 1966). Prior to the arrival of Europeans, Seton estimated that there were 10 000 000 wapiti in North America, with numbers dwindling to less than 100 000 by 1907 (Bryant and Maser 1982). Both numbers are likely overestimates, but they illustrate that wapiti were once widely distributed across North America, with the exception of the tule and Roosevelt wapiti residing along the west coast. According to the phylogenetic tree, all wapiti subspecies appear to have descended from one common ancestor, which clearly suggests a close relationship among North American animals.

As the wapiti population expanded and herds dispersed into new habitats, a few founders would eventually have moved into the remote coastal regions and given rise to the tule and Roosevelt populations. Murie (1951) suggested that the Rocky Mountain wapiti possibly gave rise to the tule and Roosevelt wapiti, although Bailey (1936, p. 78) found no fossil records to indicate that the range of Rocky Mountain wapiti was ever connected with that of the Roosevelt animals. Movement across the mountain ranges was not impossible, but likely not extensive. Both the Roosevelt and tule populations are monophyletic, which suggests that each is derived from a single lineage. Populations isolated for long periods of time generally accumulate nucleotide differences not found in other populations. These differences translate into greater genetic distances between populations. The largest number of nucleotide differences was found in comparisons between tule and Roosevelt animals. Tule and Roosevelt wapiti (Vancouver Island) have maintained their monophyletic status as a result of isolation brought about by habitat changes, reduction of their populations caused by human intervention, and the fortuitous lack of relocations of wapiti into or out of these populations.

The Roosevelt population from Olympic Peninsula National Park is comprised of a mixture of individuals with haplotypes unique to the Roosevelt form and individuals with haplotypes common to the Rocky Mountain and Manitoban forms. Presently, Washington State is home to large populations of both Roosevelt and Rocky Mountain animals (Bryant and Maser 1982), and movement between the two populations may account for the presence of Rocky Mountain / Manitoban haplotypes in wapiti in Olympic Peninsula National Park. The introduction of Yellowstone wapiti into the Wenatchee Mountains between 1913 and 1933 would have placed Rocky Mountain wapiti within reasonable travelling distance of the Olympic Peninsula population. When restriction data from Polziehn (1993), where eight Olympic Peninsula National Park animals also had the unique *Hinf*I restriction site, are included, the frequency of Rocky Mountain / Manitoban haplotypes in the Olympic Peninsula population is 22%.

A panmictic or clinal distribution was suggested for eastern, Manitoban, and Rocky Mountain wapiti (Bryant and Maser 1982; Schonewald 1994). With a few exceptions, Schonewald (1994) found a decrease in cranial size from north to south and from western Europe to North America. Blyth and Hudson (see footnote 2) suggested that the park-

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Table 3. Nucleotide substitutions in the control region of mitochondrial DNA among North American wapiti subspecies.

	Position of nucleotide substitution																			
Wapiti sample	113	181	269	315	440	442	444	448	450	476	487	488	493	541	627	679	681	694	703	709
Consensus	T	–	T	A	C	C	C	C	G	A	T	A	A	G	G	T	T	T	C	G
Riding Mountain 1	.	.	.	G	.	T	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Riding Mountain 2	.	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Riding Mountain 3/4	.	A	.	.	.	.	.	.	.	.	**C**	.	.	.	.	.	.	.	.	.
Riding Mountain 5	A	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Riding Mountain 7	.	A	.	.	.	.	.	.	.	.	**C**	.	.	.	.	.	.	.	.	.
French River 5A	.	.	.	.	.	.	.	.	.	.	**C**	.	.	.	.	C	.	.	.	A
French River B6	.	.	.	.	.	.	.	.	.	.	**C**	.	.	.	.	C	.	.	.	.
Burwash River Tl/T5(55)	.	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Elk Island 20	.	.	.	.	.	.	.	.	.	.	**C**	.	.	.	.	.	.	.	.	.
Elk Island 63	.	.	.	.	.	.	.	.	.	.	**C**	.	.	.	.	.	.	.	.	.
Elk Island 72	.	.	.	.	.	.	.	.	.	.	**C**	.	.	.	.	.	.	.	.	.
Banff 14	.	.	.	.	.	.	.	.	.	.	T	.	.	.	.	.	.	**C**	.	.
Banff 23	.	.	.	.	.	.	T	T	A	.	**C**	G	.	.	.	.	.	.	.	.
Banff 37	.	.	.	.	.	.	T	T	A	.	**C**	G	.	.	.	.	.	.	.	.
KNP/Yellowstone 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Jasper 91	.	.	.	.	.	.	.	.	A	.	**C**	.	.	.	.	.	.	.	.	.
Jasper 92	.	.	.	.	.	.	.	.	.	.	**C**	.	.	.	.	.	.	.	.	.
Yellowstone 1	.	.	.	.	T	.	.	.	A	.	.	.	.	.	.	.	.	**C**	.	.
Roosevelt 23	.	.	.	.	.	.	.	.	.	G	.	.	G	.	.	.	.	.	.	.
Roosevelt 25	.	.	.	.	.	.	.	.	A	.	.	.	G	.	.	.	.	.	.	.
Roosevelt 29	.	.	.	.	.	.	.	.	A	.	.	.	G	.	.	.	.	.	.	.
Roosevelt 32	.	.	.	.	.	.	.	.	.	.	.	.	G	.	.	.	.	.	.	.
Roosevelt 33	.	.	.	.	.	.	.	.	A	.	.	.	G	A	.	.	.	.	.	.
Tule 457	.	.	C	.	.	.	.	.	.	.	.	.	.	.	A	.	A	.	T	.
Tule 659	.	.	C	.	.	.	.	.	.	.	.	.	.	.	A	.	.	.	T	.
Sika deer 226	.	T	.	.	T	T	T	.	A	.	**C**	.	.	.	A	**C**	.	.	T	.
Sika deer 215	.	T	.	.	T	T	T	.	A	.	**C**	.	.	.	A	**C**	.	.	T	.
Red deer 765	.	T	.	.	T	T	T	.	A	.	**C**	G	.	.	.	**C**	.	**C**	T	.
Red deer 923	.	T	.	.	T	T	T	.	A	.	.	G	.	.	.	**C**	.	.	T	.

Note: Nucleotide substitutions that vary from the wapiti consensus sequence are given, and deletions are indicated by a dash.

Table 4. Divergence of mtDNA D-loop sequences from wapiti subspecies calculated from the number of nucleotide differences between individuals from each type. Values in boldface type indicate sequence variation within the subspecies (ix), values above the diagonal represent uncorrccted sequence variation within the species (d_{xy}), and values below the diagonal represent sequence divergence between subspecies corrected for intraspecific variation (tt).

	Wapiti subspecies			
	Manitoban	Rocky Mountain	Roosevelt	Tule
Manitoban	0.00326	0.01110	0.01344	0.01505
Rocky Mountain	0.00767	**0.00343**	0.01047	0.01084
Roosevelt	0.01044	0.01257	0.00275	0.01511
Tule	0.01257	0.00826	0.01288	**0.00172**

land area of central Alberta serves as a transition zone between boreal and prairie habitats, and that Rocky Mountain and Manitoban wapiti in Alberta may have genetic affinities because of overlapping ranges. A similar relationship between the historical ranges of the Manitoban and eastern subspecies can be suggested.

Elk Island National Park wapiti were assumed to be of the Manitoban form because their mtDNA grouped with that of other Manitoban wapiti, and the Manitoban wapiti range was thought to extend into this region, However, animals used to describe the Rocky Mountain form by Bailey (1935) included wapiti from Fort Saskatchewan, which is approximately 20 km west of Elk Island National Park. Perhaps the Manito¬ban wapiti ranged farther west than was previously believed, and animals from Fort Saskatchewan should not have been included in the Rocky Mountain group. However, the Elk Island National Park wapiti most likely represent animals in the transition zone, which have morphological and genetic affinities with both types. The existence of this population is likely the greatest proof that Rocky Mountain and Manitoban subspecies are the least differentiated wapiti subspecies.

Yellowstone, Elk Island, and Riding Mountain National Parks have not introduced animals from outside sources into their resident populations. Using only these three populations, one would conclude that Manitoban wapiti have a monophyl-

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Table 3. *(concluded)*

Position of nucleotide substitution																			
717	737	798	808	838	852	867	935	942	951	960	968	981	986	988	1025	1054	1117	1138	1154
G	G	C	G	G	T	C	C	C	G	T	C	–	C	T	G	A	A	G	A
.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.
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C	.	A	T	.	.	T	.	.	.	.	–	T	.	.	.	.	.	.	.
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C	.	.	T	.	.	T	.	.	.	.	–	T	.	.	.	.	.	.	.
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etic origin, assuming that both Elk Island and Riding Mountain National Park populations are of the Manitoban type. The Rocky Mountain population would be paraphyletic, as one lineage branches early in the tree and another branch shares a node with all other forms, This study provides support for the Manitoban subspecies status of wapiti in Elk Island and Riding Mountain National Parks. The sample size from Yellowstone, however, is too small to allow any strong conclusions to be drawn regarding the relationship between Rocky Mountain and Manitoban wapiti.

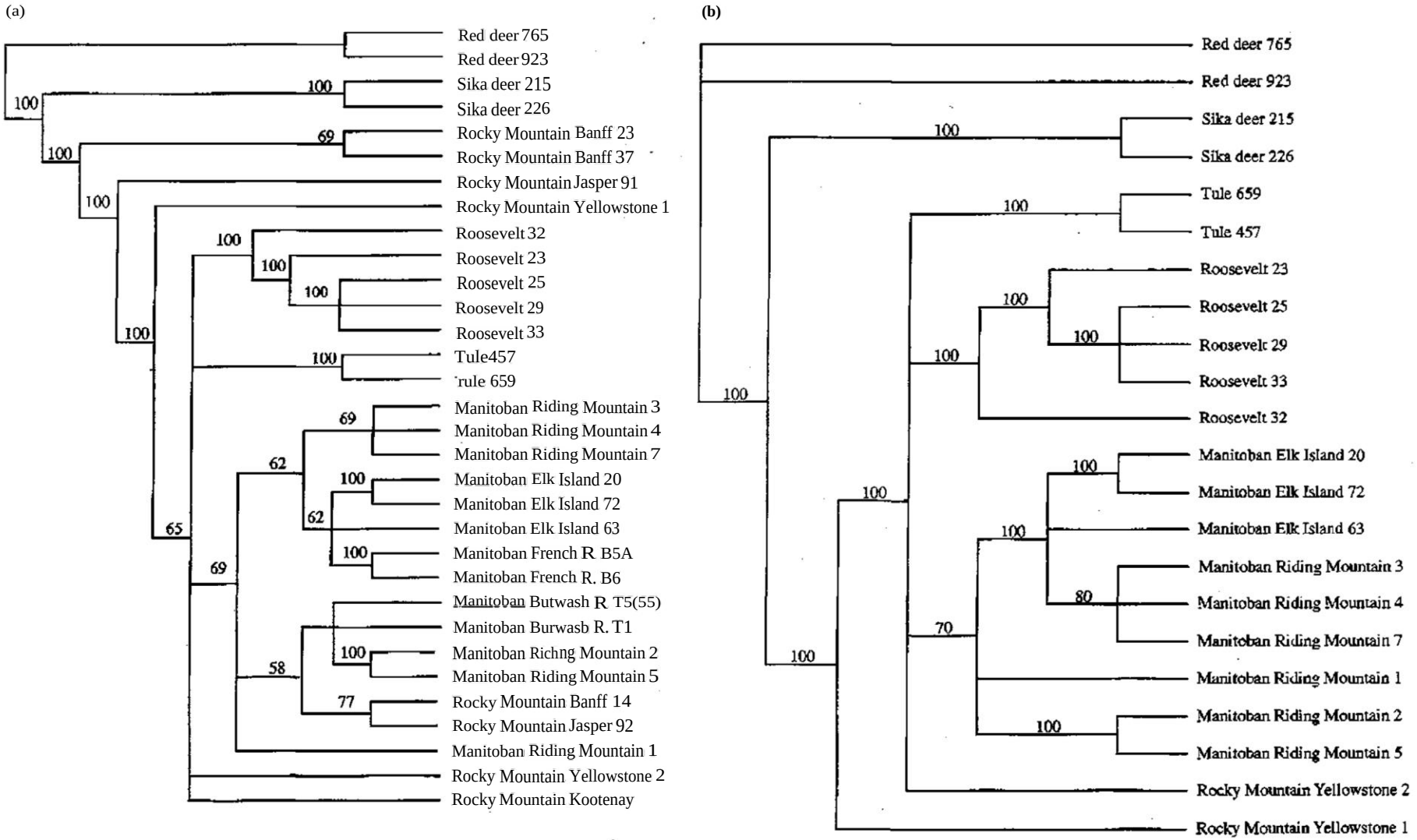
Using the complete data set, which assumes that wapiti in the Rocky Mountains are most likely of this type, results in a phylogeny that places a few animals of the Rocky Mountain and Manitoban forms in the same clade. This suggests that separation between these two groups is only in the early stages of development. The longer populations are isolated, the more likely it is that shared lineages will be lost and a transition from polyphyly to paraphyly to monophyly will occur, The Rocky Mountain animals (Banff 14 and Jasper 92) found within the clade containing Manitoban wapiti are likely descendants of animals in Yellowstone National Park, as any Elk Island National Park animals were transplanted outside these parks. The shortest genetic distances were found between these two subspecies, which suggests that separation between them is recent.

In the comparison of sequences from the mtDNA D-loop region, Burwash River and French River wapiti presently living in the range of the extinct eastern wapiti were placed in the same clades as the Manitoban or Manitoban / Rocky Mountain group. The absence of unique differences among these sequences suggests that the Burwash River and French River populations are likely not the same as those formerly belonging to the eastern wapiti. The founders of these recent populations originate from the Wainwright herd, which contained descendants from Montana, Wyoming, and (or) Ontario. If the Burwash River and French River animals are descended from lineages that could be directly linked to either Montana or Wyoming, both the Rocky Mountain and Manitoban forms would be polyphyletic.

Outside of park boundaries, one would expect to find even less evidence of distinction between Rocky Mountain and Manitoban subspecies. The Rocky Mountain wapiti in Canada are surrounded by transplanted Elk Island National Park animals, and most likely exhibit hybridization. However, isolated populations in Yellowstone National Park in the United States should represent the true Rocky Mountain

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Fig. 3. (<z) The phylogenetic relationships among North American wapiti, based on the D-loop region of mtDNA. The majority role consensus of 26 most parsimonious trees, using a 2:1 weighting oftransversions to transitions, requires 262 steps andhas a CJ value of 0.928. (6) The phylogenetic relationships among pure populations of North American wapiti, based on the D-loop region of mtDNA. The majority rule consensus of 10 most parisomonious trees, using a2:1 weighting oftransversions io transitions, requires 225 steps andhas a Cl value of 0.951.



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type. Neither Elk Island nor Riding Mountain National Park have had Rocky Mountain animals released within their borders, but both populations have the potential to hybridize with free-ranging and game-ranched animals of Rocky Mountain origin.

Overall, there is a clear lack of mtDNA variation within North American wapiti that corresponds well to the results of previous genetic studies and the lack of morphological differences. The average 0.560% genetic difference in mtDNA among North American wapiti is comparable to the 0.364% (2/549 nucleotides) observed in North American moose *(Alces alces',* Mikko and Andersson 1995) but substantially less than the 2.5% found in white-tailed deer *(Odocoileus virginianus',* Ellsworth et al. 1994).

This phylogenetic study has shown that there is a slight difference between pure wapiti populations, most likely because of the limited number of founders and the absence of wapiti introductions into these populations. Both Roosevelt wapiti from Vancouver Island and tule wapiti are monophyletic^ which, by definition, supports their subspecific status. In the absence of geographic barriers, hybridization likely took place at some time between neighboring Rocky Mountain and Manitoban animals, and both forms are found within one clade. The lack of distinction between some Rocky Mountain and Manitoban animals suggests that these two groups are at the early stages of subspeciation.

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References

Bailey, V. 1935. A new name for the Rocky Mountain elk. Proc. Biol. Soc. Wash. 48: 187-190.

Bailey, V. 1936. The mammals and life zones of Oregon. North America Fauna No. 55. U.S. Ddepartment of Agriculture, Bureau for Biological Survey, Washington, D.C,

Banfield, A.W.F. 1974. The mammals of Canada. University of Toronto Press, Toronto, Ont.

Banfield, A.W.F. 1949. An irruption of elk in Riding Mountain National Park, Manitoba. J, Wild). Manage. 13: 127-134.

Banwell, B. 1991. Slow train through China. Deer Farmer, 6; 44–43.

Berger, J., and Peacock, M. 1988. Variability of size-weight relationships in *Bison bison.* J. Mammal. 59: 618-624.

Blood, D.A., and Lovaas, A.L. 1966. Measurements and weight relationships in Manitoban elk. J. Wildl. Manage. 39: 135-140.

Bork, A.M., Strobeck, C.M., Yeb, F.C., Hudson, R.J., and Salmon, R.K. 1991. Genetic relationships of wood and plains bison based on restriction fragment length polymorphisms. Can. J. Zool. 69: 43-48.

Biyant, L.D., and Maser, C. 1982. Classification and distribution *In* Elk of North America. *Edited by* J.W. Thomas and D.E. Toweill. Stackpole Books, Harrisburg, Pa. pp. 1-59.

Cameron, D.G., and Vyse, E.R. 1978. Heterozygosity in Yellowstone Park elk, *Cervus canadensis.* Biochem. Genet. 16: 651-657.

Cotnincini, S., Sironi, M,, Bandi, C., Giunta, C., Rubini, M., and Fontana, F. 1996. RAPD analysis of systematic relationships among the Cervidae. Heredity, 76: 215-221.

Cronin, M.A. 1991. Mitochondrial DNA phylogeny of deer (Cervidae). J. Mammal. *It-.* 553-556.

Cronin, M.A, 1992. Interspecific variation in mitochondrial DNA of North American cervids. J. Mammal. 73: 70-82.

Dratch, P.A. 1986. A marker for red deer – wapiti hybrids. Proc. N.Z. Soc. Anim. Prod. 46: 179-182.

Dratch, P., and Gyllensten, U. 1985. Genetic differentiation of red deer and North American elk (wapiti). *In* Biology of deer production. *Edited by* P.F. Fennessy and K.R. Drew. R. Soc. N.Z. Bull. No. 22. pp. 37—40.

Ellsworth, D.L., Honeycutt, R.L., Silvy, N.J., Bickham, J.W., and Klimstra, W.D. 1994. Historical biogeography and contemporary patterns of mitochondrial DNA variation in white-tailed deer from the southeastern United States. Evolution, 48: 122-136.

Fontana, F, and Rubini, M. 1990. Chromosomal evolution in Cervidae. Biosystems, 24: 157-174.

Geist, V. 1971. The relationship of social evolution and dispersal in ungulates during the Pleistocene, with emphasis on the Old World deer and the genus *Bison.* Quat. Res. 1: 285-315.

Geist, V. 1991. Phantom subspecies: the wood bison, *Bison bison athabascae* Rhoads 1897, is not a valid taxon, but an ecotype. Arctic, 44: 283-300.

Ghosal, D., and Saedler, H. 1978. Mini-insertion IS2-6 and its relation to the sequence of IS2. Nature (Lond.), 275: 611-617.

Glenn, T.C., and Smith, D.R. 1993. Genetic variation and subspecific relationships of Michigan elk *(Cervus elaphus).* J. Mammal. 74:782-792.

Green, H.U. 1956. Notes on the elk of Banff National Park. National Park Service, Ottawa.

Guthrie, R.D. 1966. The extinct wapiti of Alaska and Yukon territory. Can. J. Zool. 44: 47-57.

Houston, D.13. 1974. The northern elk: ecology and management. Macmillan Publishing Co., New York.

Hutton, D.A. 1972. Variation in the skulls and antlers of wapiti *(Cervus elaphus nelsoni* Bailey). M.Sc. thesis, University of Calgary, Calgary, Alta.

Kay, C.E., Patton, B., and White, C.A. 1994. Assessment of long term terrestrial ecosystem slates and processess in Banff National Park and the central Canadian Rockies. Parks Canada, Banff National Park, Banff, Alta.

Kocher, T.D., Thomas, W.K., Meyer, A., Edwards, S.V., Paabo S., and Villablanca, F.X. 1989. Dynamics of mitochondrial DNA evolution in animals: amplification and sequencing with conserved primers. Evolution, 86: 6196-6200.

Kucera, J. 1991. Genetic variability in tule elk. Calif, Fish Game, 77: 70-78.

Lloyd, H. 1927. Transfer of elk for restocking. Can. Field-Nat. 41: 126-127.

McCullough, D.R. 1969. The tule elk: its histoiy, behavior, and ecology. Univ. Calif. Publ, Zool. 88: 1-209.

McHugh, T. 1972. Time of the buffalo. Alfred A. Knopf, New York.

Mikko, S., and Andersson, L. 1995. Low major histocompatibility complex class II diversity in European and North American moose. Proc. Natl. Acad. Sci. U.S.A. 92: 5259—1265.

Moritz, C. 1994. Defining 'evolutionarily significant units' for conservation. Trends Ecol. Evol. 9: 373-375.

Murie, J.O. 1951. The elk of North America. Stackpole Books, Harrisburg, Pa.

Murray, B.W., McClymont, R.A., and Strobeck, C. 1995. Forensic identification of ungulate species using restriction digest of PCR-amplified mitochondrial DNA. J. Forensic Sci, 40: 943-951.

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Nei, M. 1987. Molecular evolutionary genetics. Columbia University Press, New York. pp. 254-286.
Peek, J.M. 1982. Elk *(Cervus elaphus). In* Wild mammals of North America. *Edited by* J.A. Chapman and G.A. Feldhamer, John Hopkins University Press, Baltimore, pp. 851-861
Pielou, E.C. 1991. After the ice-age: the return of life to glaciated North America. University of Chicago Press. Chicago.
Polziehn, R.O> 1993. Subspecific variation within the d-loop region of mitochondrial DNA of bison *(Bison bison)* and wapiti *(Cervus elaphus).* M.Sc. thesis, University of Alberta, Edmonton.
Quimby, D.C., and Johnson, D.E. 1951. Weights and measurements of Rocky Mountain elk. J. Wildl. Manage. 15: 57-62.
Schonewald, C. 1994. *Cervus canadensis* and *C. elaphus'.* North American subspecies and evaluation of clinal extremes. Acta Theriol. 39: 431—452
Schwartz, J.E., and Mitchell, G.E. 1945. The Roosevelt elk on the Olympic Peninsula, Washington. J. Wildl. Manage. 9: 295-319.
Soper, J.D. 1946. Mammals of the Northern Great Plains along the international boundary in Canada. J. Mammal. 46: 127-153.
Spalding, D.J. 1992. The history of elk *(Cervus elaphus)* in British Columbia. Publ. No. 18, Royal British Columbia Museum, Vancouver. pp. 1-27.
Stelfox, J.B., and Stelfox, J.G. 1993. Distribution. *In* Hoofed mammals of Alberta. *Edited by* J.B. Stelfox. Lone Pine Publishing, Edmonton, Alta. pp. 45-62
Swofford, D.L. 1993. Phylogenetic analysis using parsimony. Version 3.1. Computer program distributed by the Illinois Natural History Survey, Champaign.

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Redwood
National and State Parks

National Park Service
U.S. Department of the Interior

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Parks & Recreation

2017 HERD UNIT CLASSIFICATION AND MANAGEMENT OF ROOSEVELT ELK



Photo: Redwood National and State Parks

June 2018

INTRODUCTION

The Roosevelt elk *(Cervus elaphus roosevelti),* the largest of the six recognized North American elk subspecies, once occurred from southern British Columbia to Sonoma County, California, With the arrival of European and other foreign settlers intense hunting began in the mid-1800s and the Roosevelt elk's range was greatly reduced. From 1848 through 1855, market hunting for elk hide and meat supplied gold miners during the northern California gold rush. When the gold rush was over a large amount of elk habitat was converted to cattle and sheep ranching and croplands, and elk were killed to protect against crop depredation. Elk populations and distribution in the Marble and Siskiyou Mountains and the Salmon-Trinity Alps were significantly reduced (USDI 1983). The only Roosevelt elk populations that persisted through this period were those occupying coastal lowlands in northern California, where dense forests and brush fields provided protective cover. Today Roosevelt elk in California persist only in Humboldt and Del Norte Counties, and extreme western Siskiyou County.

Prior to foreign settlers' arrival, local tribes (Yurok, Chilula, and Hupa) living in and around what is now Redwood National and State Parks (RNSP or "parks") burned prairies, grasslands, and forest openings to promote new growth of plants attractive to elk as forage. Tribal use of elk for subsistence presumably had little impact on elk populations in comparison to population declines following settlement.

The Redwood National Park *Elk Management Report* (Hofstra *et al.* 1986) stated the long term goal for elk within Redwood National and State Parks is "...an elk population in equilibrium with the environment, regulated by vegetation dynamics, predation, competition with other species, and other natural forces." It goes on to acknowledge that achieving this goal may be "problematic at Redwood, given its configuration, relatively small size, land use history, adjacent activities, and habitat needs of elk."

Work in RNSP

Annual classification of elk herds within RNSP began in 1996 to document relative abundance and simple population characteristics such as cow numbers, recruitment, and calf survival within known herds (Wallen 1997). These herd count/classifications have been conducted annually each fall since that time by parks staff and others. Also in 1996, a monitoring program of the elk population in the Prairie Creek drainage was established independent of the RNSP program (Weckerly 1996, Weckerly *et al.* 2004). The 2 independent monitoring programs in the same area provided a unique opportunity to compare data gathered without using a standardized protocol with data gathered using a more rigorous approach using a standardized protocol associated with hypothesis testing.

Beginning in 2004, Dr. Floyd (Butch) Weckerly counted elk in the Bald Hills using a method he developed (Weckerly and Francis 2004). The Prairie Creek herd counts tended to yield similar results using the parks' and Weckerly's survey methods. However, the Bald Hills herd counts tended to be quite dissimilar between park staff and Weckerly, with staff counts consistently undercounting the number of animals. Because of this, staff counts were discontinued in the Bald Hills.

METHODS

Seven separate herds were originally counted/classified within RNSP. In 2015, 2 herds coalesced and have remained so through January 2018, resulting in 6 herds now being counted within RNSP. Five of these herds are counted by park staff from September through November, the fall herd classification period, The Bald Hills herd was counted 10 times in January by Dr. Weckerly. Surveys by Dr. Weckerly associated with Prairie Creek herd monitoring also were conducted in January 2018. Results from these latter 2 surveys are considered part of the 2017 elk count period and are included in this report with the fall 2017 information. This is compatible with how survey results have been reported in previous reports. The 6 herd units are:

(1) **Old South Operations Center** (OSOC) herd (combined with the former **Lower Redwood Creek** (LRCR herd))
(2) **Davison Ranch** (DARA) herd
(3) **Elk Prairie/Hwy 101 Bypass** herd (EPBY)
(4) **Gold Bluffs Beach (GOBB)** herd
(5) **Crescent Beach Education Center (CBEC)** herd
(6) **Bald Hills** (BAHI) herd

Detailed descriptions of the locations of herd units appear under Herd Summaries on page 7.

Classification counts were conducted by park staff either driving or hiking to the herd units, and using binoculars and spotting scopes to count elk. Staff recorded the total number of elk observed, and the total number of elk within each classification group. The classification groups are mature bulls, spikes (first year males identified by a lack of brow tine off the main beam), cows, and calves, The observers assigned ranking criteria to the classification counts that specified the accuracy of the count, using a scale of 1 to 4. A rating of 1 indicated good visibility with the animals close enough to accurately count and classify the herd. A rating of 4 indicated that the observation was unacceptable for determining herd composition because of poor visibility due to low light level, fog, vegetation, or topography. The highest cow count with a favorable ranking was used as the herd size estimate and for calculating calfxow and bullxow ratios.

Fall Count Herd Classification Groups

- Cows = all females >1 year old.
- **Calves =** young of the year <1 year old (recognized by spotted coat and small size; later the spots disappear, but calves retain a short, rounded snout).
- Spikes = year-old males exhibiting only a main beam, brow tine/antler branching absent.
- **Mature bulls =** males ≥2 years, with brow tine evident off the main beam.

Fall Count Herd Observation Ranking Criteria

1 = Good, visibility good and animals close enough to observe with high confidence of an accurate count and classification.

2 = Fair, animals are either distant or another factor made the observer less than fully confident in classification (e.g. some vegetation blocking full view or movement into cover while counting).
3 = Poor, animals too far away (e.g. difficult to track individuals or animals are in adjacent hiding cover).
4 = Unacceptable, bad visibility due to low light levels, fog, or other factors.

During January surveys, elk in the Bald Hills were counted from vantage points accessible by vehicle or approached on foot. A set route was driven/walked on 10 different days. Observers approaching elk groups on foot did so to obtain an unobstructed view or to conduct a coordinated stalk. A coordinated stalk consisted of an attempt by a first surveyor to alert an elk group to his or her presence so that the group moved in such a manner that they could be counted by a second surveyor. All animals within 50 m (-165 ft) of one another displaying coordinated activity or movement were considered a group (Weckerly *et al.* 2004). The highest cow count with a favorable ranking was used as the herd size estimate and for calculating calf:cow and bulkcow ratios.

RESULTS AND DISCUSSION

Fall classification counts and the winter 2018 classification count for the BAHI herd are presented in Table 1. It should be noted that the parks' DARA and EPBY herds are combined in Weckerly's "Prairie Creek" herd. Table 1 numbers for DARA and EPBY reflect fall staff counts.

Table 1. Highest number of elk reported within each herd unit and for each fall classification grouping in 2017. MB = mature bull, SP = spike, CW = cow, CV = calf, n = total fall counts when animals were observed.

Herd	MB	SP	CW	CV	Total	n
OSOC	6	10	35	10	61	3
BAHI[1]	2	17	153	27	199	10
DARA	4	6	45	14	69	3
CBEC[2]	N/A	N/A	N/A	N/A	59	2
GOBB	1	0	14	7	22	4
EPBY	2	0	2	1	5	3

The January 2018 Prairie Creek herd estimate was 74 (F. Weckerly, pers. comm.). The staff count for the DARA/EPBY and DARA herds combined also was 74. Calf and spike numbers matched closely between the 2 counts, however, cow and bull numbers did not. Staff counted 6 bulls, Weckerly counted 12, and staff counted 7 more cows than did Weckerly. The Gold Bluffs Beach counts were nearly identical between counts for both total numbers and classification. The total OSOC herd numbers differed by 1 between the 2 counts, due to differences in cow/calf classifications. Overall the numbers indicate good reliability with staff counts and classification for herds below the Bald Hills in the parks.

[1] The high count for this herd, on January 12, was 277 but with few animals classified. Table numbers demonstrate animals classified in the herd during the next highest count on January 15.
[2] This herd was not classified in 2017.

Cow counts by year, the best indicator of herd persistence (McCullough *et al*. 1994, Weckerly and Francis 2004, Weckerly 2017), are displayed in Figure 1. Cow numbers for all herds for all years are provided in Appendix A. In 2015, the OSOC and LRCR herds coalesced into a single herd, now referred to as the OSOC herd.

In the fall, staff observed a small group of 2 bulls, 2 cows and 1 calf in Elk Prairie, home of the EPBY herd. In June, 2 cows, each with a calf, plus 9 bulls were observed in Elk Prairie. Weckerly observed only bulls (9-10) in Elk Prairie in January (F. Weckerly, pers. comm.). The GOBB herd, that normally ranges widely over a large area and is difficult to count, was observed as an all-ages group. Except for 2013 when the count was 25, the 2016 cow count for GOBB was the highest it's been (22) since 2002 (Figure 1).

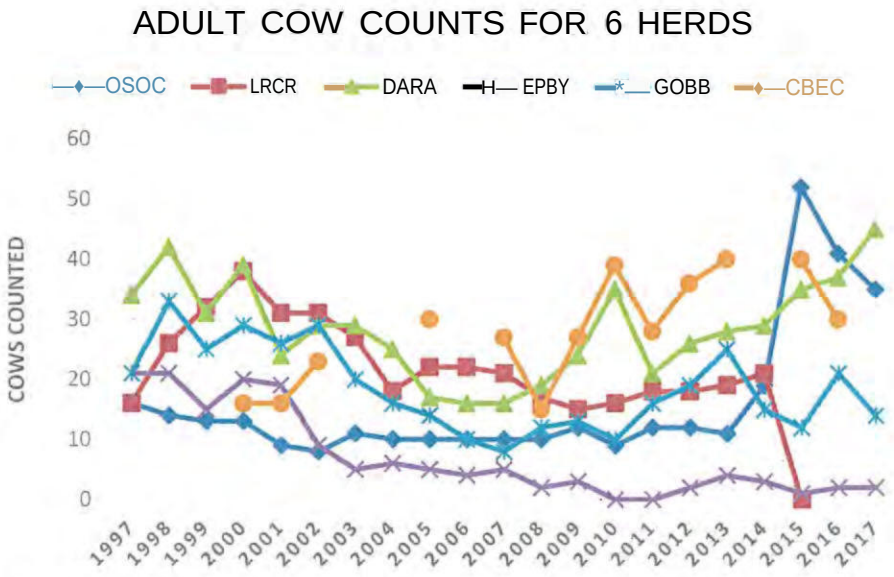


Figure 1. RNSP fall elk herd cow numbers from 1997 to 2017 indicating herd persistence through time. The CBEC herd counts are opportunistic each year, missing data points do not represent zeros. The LRCR and OSOC herds merged in 2015.

The highest fall cow count in each herd was used to determine calf:cow ratios; the ratio of calves to cows is an indication of herd productivity. The ratio of calves to cows in the coalesced OSOC/LRCR herd, continued to be low for the 3rd year since the two herds combined in 2015 (Table 2).

Table 2. Calves per 100 cows for coastal elk herd counts, 2003 to 2015 (N/A = data not available).

Herd	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
OSOC	27	10	40	30	40	40	25	55	16	8	45	32	29	34	28
LRCR	11	22	18	45	33	23	20	56	44	61	58	29	---[1]	---[1]	▬[1]
DARA	21	24	12	18	56	37	33	22	38	18	42	38	29	27	31
EPBY	20	50	0	25	60	100	33	0	0	50	30	1002	1002	1002	50
GOBB	15	6	17	30	50	50	54	60	44	53	20	53	17	24	50
CBEC	N/A	N/A	N/A	N/A	30	40	30	5	14	28	20	N/A	37	53	N/A

1 The ratio is included in the OSOC herd ratio due to herds coalescing.
2 The 1:1 calf/cow ratio was due to 1 cow present with a calf.

In January 2018, the calf:cow ratio in Weckerly's Prairie Creek herd was 0.40 (F.Weckerly, pers. comm.). The fall staff counts indicated a calf cow ratio of 0.32 when the EPBY and DARA herds were combined and 0.31 for the DARA herd alone. In 2017, staff counted 15 calves in the 2 herds combined; Weckerly's count was 16. No cows or calves were present in January 2018 when Weckerly surveyed Elk Prairie. Given that the staff fall count and Weckerly's January count were equal it is probable that staff misclassified large calves as cows during their high count that occurred on October 2.

This year it was possible to calculate the calf:cow ratio for the Bald Hills herd, but the January 2018 ratio was based on the day with the second highest number of animals counted. Classification is difficult with this herd due to its size and juxtaposition within the landscape. To get an accurate herd count and classification, conditions for viewing the animals must be optimal, e.g., the herd is in clear view or moving in single file across an opening. The calf:cow ratio for this herd was 0.18 in January 2018, down from 0.26 in January 2017.

Bulkcow ratios may indicate the quantity of available forage. Like many large herbivores, male and female Roosevelt elk partition habitat spatially. In the Elk Prairie and Davison meadows (EPBY and DARA herds) males are more likely to use forests that have lower quantities of forage, biomass and thus forage more widely (Weckerly 2005). Also, when food is less abundant males may use forested habitats more frequently, malting direct observation difficult (Weckerly *et al.* 2004, Weckerly 2007). In January 2018, Weckerly observed a bulkcow ratio of 0.25 for the Prairie Creek herd, nearly double the 0.13 ratio staff found for the DARA/EPBY herds combined the previous fall. This was similar to the discrepancy between the fall and January ratios in 2016; in fact, there has been only 1 year in the last 10 when the bulkcow ratio was greater in the fall than in January (Figure 2). The cause of the lower fall bulkcow ratios could be due to differences in methodology between the 2 counts. Ratios from staff counts are based on actual numbers of animals observed, while Weckerly uses a mark-resight method that accounts for imperfect detection, and use Bowden's estimator to adjust for biased low sex ratio estimates (Weaver and Weckerly 2011, Bliss and Weckerly 2016).

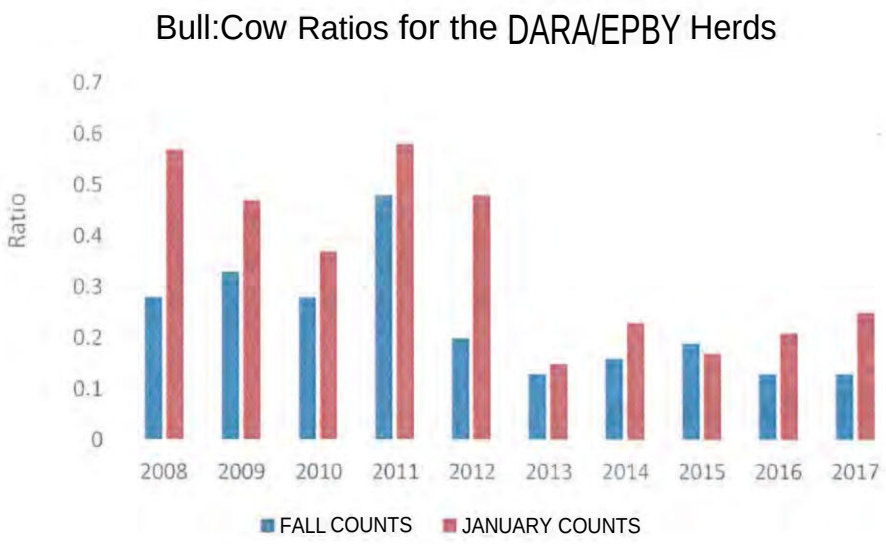


Figure 2. BulkCow ratios for the DARA/EPBY (Weckerly's Prairie Creek) herd during a 10-year period. Fall counts are done by park staff Sept.-Nov. and Weckerly's are done in January of the following year.

Herd Summaries

Old South Operations Center (OSOC)

The total count for the OSOC herd was down by 10 from 2016. However, there were only 2 counts obtained in 2017, compared to 7 in 2016. The Lower Redwood Creek herd (sometimes referred to as the "Levee" herd in previous reports) coalesced with the OSOC herd in 2014 (RNSP 2015) after a local landowner opened his gated cow pasture which permitted elk access to the pasture. Elk ingress and egress between the private pasture and the park has ostensibly been occurring ever since. The increased available food resource is likely the cause for the breakdown in separation previously kept by the OSOC and LRCR herds, and perhaps due to an increased threat of hunting in the private pastures adjacent to the park (Kolbe and Weckerly 2015, Weckerly 2017). Weckerly's best count was 39 cows and 7 calves, the staff count was 35 cows and 10 calves.

Davison Ranch (DARA) Herd

This herd consists of a group of mature bulls that often occupies the northern portion of Elk Meadow north to the Lost Man Creek Fish Hatchery, and a cow group that occupies the southern portion of Elk Meadow south to Skunk Cabbage Creek. These animals also frequent the Redwood Adventures Lodge property west of Highway 101 and, on the east side of the highway, the lawn of the Green Diamond Resource Company office, the private residence across from the footbridge over Prairie Creek and the cow pasture west of the former Mill A site. The number of cows counted by staff (45) matched last year's highest-ever recorded for the herd, and when the 2 cows from EPBY observed in the fall are included, the number matches Weckerly's January count of 47 for the Prairie Creek herd. The calf:cow ratio was 0.31 in 2017, up from 0.27 in 2016

but below 0.38 of 2014. The bulkcow ratio was way down, at 0.09, however this didn't take into account the animals from the EPBY herd. Weckerly reported a bulkcow ratio of 0.30 in January 2018 that included 10 bulls from the EPBY herd.

Elk Prairie /Hwy 101 Bypass (EPBY) Herd

This herd, considered extinct (Weckerly 2017) consisted of a small group of 5 animals in fall 2017 that included 2 bulls, 2 cows and 1 calf. Earlier in the year 2 calves were seen and in late June a park employee reported a herd of 13 including the 2 cows with their calves, plus males of which 2 may have been spikes.

Gold Bluff Beach (GOBB) Herd

The GOBB herd uses a large area that extends from Mussel Point at the south end of Gold Bluffs Beach to Carruther's Cove near the northern limit of this beach, a distance of 12 miles. They also on occasion leave the beach area, moving into the forest above the beach and east towards Newton B. Drury Parkway. This herd is difficult to count because of the large area the animals use and the brushy nature of the coastal bluffs which can obscure individuals. The number of cows counted (14) was below those counted last year but similar to numbers of recent years (see Appendix A). In contrast, the bulkcow ratio was the lowest on record at 0.05, with only 1 bull present with the cow group for the second year in a row. However, on July 26, 2017, 3 bulls were observed with the cow group. Weckerly also counted 14 cows on 4 days and saw either 1 or no bulls.

Crescent Beach Education Center (CBEC) Herd

The CBEC herd is most often counted from the education center office, whose windows face the meadow west of the building. This herd was not classified in fall 2017 due to limited staffing. On July 4, 2017, 32 cows, 16 calves, 4 spikes and 3 bulls were recorded lying down in the meadow close to the office. This is 4 fewer animals than were recorded in the total (unclassified) herd in September.

Bald Hills (BAHI) Herd

There were 10 counts in the Bald Hills in 2018, from January 4 to January 16. The high count in 2018 for the BAHI herd was 276, not including the 1 bull observed, an increase over last year's 247. The cow count was 153 when the total herd count was 197; this cow count was lower than in most years since 2012.

Winter survey routes in the Bald Hills are available in previous unpublished annual elk reports (Bensen 2005, Schmidt 2009).

Other Observations

There were 8 incidental observations recorded in the parks' Wildlife Observations database in 2017, most of which were turned in by staff. One report was of an apparently sick animal lying

"limp" on the ground, and another of a female limping heavily while other females were behaving aggressively toward her.

Incidents

Calving Season

There were 3 reported incidents involving aggressive cow elk in 2017. Two reports were from the GOBB calving area around Fem Canyon. The first, near the Fern Canyon parking lot, was on May 8 when 18 animals consisting of "cows and large calves" were encountered by 2 separate groups of visitors on the trail. According to the report, 3 elk would not move out of the trail and one elk bluff-charged a man. The elk approached within "2 arms' length". Another group of people *approached the elk to* within "1 arm's length or closer".

Two days later on May 10, 200 ft from the Fern Canyon trailhead the entire herd was feeding near the trail. At 6:30 p.m. 4 visitors passed by the animals without incident. On the way back at 7:30 p.m. the elk had moved to the east side of the trail. They alerted but did not move. The pair of hikers decided to wait for the elk to move. At 8:00 p.m. the pair approached the herd that was now on the side of the trail and in the parking lot. The largest animal, assumed to be a bull, walked toward the 2 people. At approximately 10:30 p.m. the pair were able to get to their friends after the elk moved into the grassy area south of the parking lot.

At the Elk Meadow viewing area (DARA herd), on June 15 there were many people watching elk. One cow trotted through the group of people. A woman was getting close and the elk looked agitated. A uniformed NPS employee asked the woman to return to the parking lot and addressed others in the crowd about the importance of keeping a distance between themselves and the elk. A man behind the employee then approached a different cow elk. When the employee turned around, the elk was chasing the man. The elk got within 2-3 ft when the man got around his car. When the he took out a camera and started back to toward the elk, he was stopped by the employee.

Rut

There was 1 report of aggression during the rut in 2017. On September 20, a bugling bull came around a corner and approached a park work crew that was pulling ivy on the edge of a road near an old mill site. It approached the group who retreated to their vehicles. The bull rejoined the herd after which the crew heard what sounded like the animals "fighting" in the vegetation.

Other

On December 5, well past the rut, a bull and 8 cows plus at least 1 calf blocked access to Fern Canyon at the parking lot. The bull purposefully walked towards any hiker that tried to walk past on the trail and was intimidating people. Five people waited 30 minutes and could not pass. Twelve people joined into a group and were able to walk by slowly on their way to the canyon.

Entanglements

There were no instances of antler entanglements in the parks in 2017.

Mortality/Injury

There were 2 known elk mortalities and 1 minor injury documented in RNSP in 2017. On February 1, the carcass of a poached female was discovered off of Bald Hills Road in Childs Hill Prairie, The hindquarters and other meat were removed, the guts and other parts were left. On September 28, a dead female with a clean cut around the groin area was reported to and observed by a California Department of Fish and Wildlife (CDFW) Warden along Davison Road near Highway 101. The head and rumen were located near the Cal Trans yard across from Geneva (a.k.a. Lost Man Creek) Road. On October 4, staff followed up on a report of an injured elk near Elk Prairie Campground that had an open chest (puncture-like) wound possibly caused by another elk.

Annual Elk Hunts

CDFW and the California State Fish and Game Commission regulate elk hunting in the State of California. Although no hunting is allowed in RNSP, CDFW's Northwestern California Roosevelt Elk Hunt includes lands in Humboldt and Del Norte counties in the vicinity of RNSP. This hunt may impact RNSP animals. Hunters acquire elk tags for this hunt by lottery draw; 15 bull tags and 3 either-sex tags were issued in 2017 for the Northwestern California hunt. Of these, 6 bulls were taken in the vicinity of Orick.

In 2016, the Shared Habitat Alliance for Recreational Enhancement (SHARE) program was created to improve public access to private land. One ranch in the Orick Valley is enrolled in this program; it was issued 3 tags in 2017, and 1 bull and 1 cow were taken. These animals and those from the Northwestern Hunt likely were from the OSOC herd.

The Private Lands Management (PLM) program offers landowners incentives to manage their lands for the benefit of wildlife through habitat conservation efforts. Green Diamond Resource Company (GDRC) and Stover Ranch hosted PLM hunts in the Bald Hills adjacent to or in the vicinity of the park. GDRC was issued 3 bull and 2 antlerless tags for this PLM in 2017. The hunt was 60% successful with 2 bulls and 1 cow harvested. The Stover Ranch was issued 4 bull and 2 antlerless tags. Four bull and 1 antlerless tags were filled for an 83% success rate. Both the Klamath and Stover Ranch hunts may impact the BAHI herd.

CDFW Project: ***Investigating Abundance and Population Demography of Elk in Northwestern California***

Elk capture efforts for this research project began in January 2017. Adult cow elk were darted (tranquilized) and fitted with a GPS transmitter and ear tags prior to release. Eight elk from park herds were captured in 2017: 2 from the BAHI herd; 2 from OSOC; 2 from DARA; 1 from GOBB; and 1 from CBEC. In addition, 9 calves were captured and ear-tagged with VHF transmitters. The calves "were from all of the above herds except GOBB. Ail but 3 of the tagged calves either died or the tags failed within weeks or months of tagging (CDFW 2017). The study

is ongoing in 2018. Seven undergraduate and 4 graduate studies are associated with this project. The Humboldt State University graduate studies are:

Erin Nigon
Title: Dynamics of neonate elk survival and mortality in Northern California

Summary: Juvenile survival is known to be highly variable, yet is fundamental to understand what drives change in wildlife populations and necessary for successful game management. Factors influencing calf survival in Roosevelt elk populations in northwestern California are poorly understood. This study will monitor GPS collared elk and radio-tagged elk calves in Del Norte and Humboldt counties for two years. The objectives of this study are to 1) estimate calf survival and determine recruitment rates for Roosevelt Elk in the area 2) evaluate the effects of sex, body mass, and birth date on annual calf survival and 3) identify factors influencing elk survival by investigating mortalities across all age classes.

Rudy Mena
Title: Herd counts and composition, habitat use and movements of Roosevelt elk in Northern California.

Summary: The objective of this study is to determine the efficacy of fecal pellet counts for use in population size estimates via fecal capture-recapture during a period of increased social cohesion of Roosevelt elk groups. This project aims to determine if: 1) fecal pellet distribution within elk home ranges can accurately describe group habitat use, and as a result 2) that site fidelity of elk groups increases the capture rates of individuals during fecal mark-recapture sampling occasions.

Emily Armstrong Buck
Title: Escherichia coli and Salmonella enterica in Roosevelt elk and cattle: enteric pathogens at the wildlife-domestic interface

Summary: This study will evaluate the prevalence of pathogens and parasites in elk and cattle in a preliminary attempt to determine risks of spillover and spillback between these species and may provide insight into demographic patterns observed. Specifically, the prevalence of Salmonella enterica and Escherichia coli are being examined in elk and domestic cattle.

Adam Mohr
Title: Habitat selection of Roosevelt and Tule elk

Summary: This study will use the location data collected from collared cow elk to investigate different aspects of their spatial ecology. A major component of this will be modeling the influence environmental factors (e.g. vegetation type, elevation, drought, development etc.) have on elk habitat selection. This will be done by applying newly developed spatial analysis techniques to gain new insight into elk travel corridors, parturition-related movements, and early neonatal survival.

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Report prepared by Kristin Schmidt, Wildlife Biologist, Redwood National and State Parks

Acknowledgments: Thanks to Kyle Max, Heather Brown, and Gary Sousa for the fall counts in the Orick Valley and to the CBEC Interpretation staff for keeping an eye on that herd. Thanks to Terry Hines for her help with gathering up bits and pieces of elk data for this report and to Carrington Hilson for providing information on area elk hunts.

REFERENCES

Bensen, K. 2005. Herd unit classification of Roosevelt elk. Unpub. Rept. on file at South Operations Center, Orick CA 14 pp.

Bliss, L.M. and F.W. Weckerly. 2016. Habitat use by male and female Roosevelt elk in northwestern California. California Fish and Game 102(1):8-16.

California Dept of Fish and Wildlife. 2017. Investigating abundance and population demography of elk in Northwestern California. Annual Progress Report for California State Parks and Redwood National and State Park. State Parks permit #18-635-007. National Parks permit #REDW-2017-SCI-0025.

Hofstra, T., J. Sacklin, S. Veirs, A. Zakis, S. Hurd, J. Grenier, and T. Marquette. 1986. Elk management report, Redwood National Park, Arcata, CA. Unpub. Rept. on file at South Operations Center, Orick CA

Kolbe, N. R., and F. W. Weckerly. 2015. Home-range overlap of Roosevelt elk herds in the Bald Hills of Redwood National Park. California Fish and Game 101:208-217.

McCullough, D.R., F.W. Weckerly, P.I. Garcia, and R.R. Evett. 1994. Sources of inaccuracy in black-tailed deer herd composition counts. J. of Wildl. Mgmt 58:319-329.

RNSP [Redwood National and State Parks]. 2015. 2014 Herd Unit Classification and Management of Roosevelt Elk – Redwood National and State Parks. Unpublished Report on file at South Operations Center, Orick CA. 13 pp.

Schmidt, K. 2009. 2008 Herd unit classification of Roosevelt elk. Unpub. Rept. on file at South Operations Center, Orick CA 17 pp.

USDI [U.S. Department of the Interior], 1983. Elk live trapping and relocation environmental assessment. Redwood National Park, Arcata, California. 11 pp. On file at South Operations Center, Orick, CA.

Wallen, R. L. 1997. Monitoring abundance and distribution of Roosevelt elk in 1996 in Redwood National and State Paries. Annual project report. Unpub. Rept. on file at South Operations Center, Orick CA 6 pp.

Weaver, S.P. and F.W. Weckerly. 2011. Sex ratio estimates of elk using counts and Bowden's estimator. California Fish and Game 97(3):130-137.

Weckerly, B. 2017. Population ecology of Roosevelt elk; conservation and management in Redwood National and State Parks. University of Nevada Press.

Weckerly, F.W. 1996. Roosevelt elk along the Prairie Creek drainage: an evaluation of estimating abundance and herd composition. California Fish and Game 82:175-181.

Weckerly, F.W. 2005. Grass and supplemental patch selection by a population of Roosevelt elk. J. Mamm. 86(3):63O-638.

Weckerly, F.W. 2007. Constant proportionality in the female segment of a Roosevelt elk population. J. Wildl. Mgmt. 71(3): 773-777.

Weckerly, F.W. and D.R. Francis. 2004. Elk in north coastal California: habitat suitability, sign survey utility and population monitoring. Dept, of Biology, Texas State University, San Marcos, Texas. Unpub..Rept. on file at South Operations Center, Redwood National and State Parks, Orick, CA. 61pp.

Weckerly, F. W., McFarland, K. A., Ricca, M. A., and Meyer, K. P. 2004. Cropping rates, social affinity and sexual segregation in Roosevelt elk when population density changes. American Midland Naturalist 152:386-389.

PERSONAL COMMUNICATION

Dr. Floyd "Butch" Weckerly, Texas State University, San Marcos, TX

Appendix A

Highest reliable (ranking <3) cow counts for identified elk herds, 1998 to 2017 (data displayed, in part, in Figure 1 in the report). ND = no data available for that year.

Herd	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
OSOC	14	13	13	9	8	11	10	10	10	10	10	12	9	12	12	11	19	52	41	35
LRCR	26	32	38	31	31	27	18	22	22	21	17	15	16	18	18	19	21	8	N7A	N/A
BAHI*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	188	240	193	131	191	153
DARA	42	31	39	24	29	29	25	17	16	16	19	15	23	21	28	26	29	35	37	45
EPBY	21	15	20	19	9	5	6	5	4	5	2	3	0	0	2	4	3	1	2**	2
GOBB	33	25	29	26	29	20	16	14	10	8	12	13	10	16	19	25	15	12	21	14
CBEC	ND	ND	16	ND	23	ND	ND	30	ND	27	15	27	39	28	36	40	ND	40	30	ND

* Classification of this herd has only been possible since 2012.

**From opportunistic counts in late July 2016.

April 5, 2019

Dear Director Charles Bonham and Wildlife Branch Chief,

Thank you for the opportunity to engage in the process regarding the the SEIR draft on Elk Hunting dated February 14, 2019. I thank you for collating the separate Elk Hunt programs' data into an overall tags allotted and numbers killed. Road kills, predation of young, poaching information available should also be included in this number. Each harvest impacts the population numbers of elk and total population is integral to effective management and quotas.

My comments primarily apply to the Roosevelt Elk hunt in the Northwest Hunt Zone where I reside.
I am disappointed that the Draft is still utilizing the department's 1987 non-peer reviewed computer model for determining tag numbers. Humboldt State University has been collaborating with CDFW for over two years now and estimate a population of 990 elk in the Northwest hunt zone (significantly lower than 1600 as a desired population goal), and Redwood National Park has approximately 20 years of data regarding elk populations in the northwestern hunt area, albeit on lands not available to hunt. However, elk do not remain solely on non hunt properties. It may be possible to run these data through the elk pop computer model and justify or refute the elk pop model's veracity.
I am also disappointed that the draft SEIR doesn't analyze any decreased tag number elk hunt alternatives, just summarily dismisses them. Nor does the SEIR focus on the non-hunting recreational opportunities the elk present for residents, tourists, visitors to the region and that impact on the local economies.

A literature search shows that previous hunting/predation studies indicate that hunting and predation are not equivalent population controls. With a present absence of significant predators on adult elk, (wolves, grizzlies are two examples), hunters' role can become invaluable in population dynamics. However, without specific tag targets such as predominance on antlerless and spikes, the diseased and the infirmed, hunters' takes can hinder the success of a population. The hunters' demands for antlered elk may negatively impact overall population dynamics.

Here again, the computer model seems unsatisfactory in that it doesn't generate age distributions of populations nor real changes in age distributions over time.

Additionally, given the reality of Climate Change and uncertainties there within, increasing the hunting tag allotments without data to support, seems irresponsible to me.

Again, I thank you for the opportunity to opine on the draft SEIR and I recommend a more thorough and thoughtful analysis be completed and presented to the Fish and Game Commission.

Sincerely,

Janet Gilbert

Sent from my iPhone

PUBLIC INTEREST COALITION

[sent via email: fgc@fgc.ca.gov] May 3, 2019
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Ladies and Gentlemen:

Re: Comments for FGC, 5/16/19, Agd Item 3

Please accept our comments for both the May FGC meeting and inclusion as public comments in the administrative record of the CEQA review.

Bighorn Sheep Hunting

Hunting periods ranging from two to three months (as indicated in the "Statement of Reasons, page 9 of 270) are entirely too long. Disruptions and stress induced from being hunted and/or being shot at, wounded, maimed, etc., can cause targeted and non-targeted wildlife to become more skittish and secluded, thereby depriving the non-killing public (nonconsumptives) of their rightful viewing or photographing experiences. No hunting period should last more than six weeks at the most.

Draft Supplemental DED comments—Elk Hunting

We fully support comments submitted by Phoebe Lenhard (4/3/19), Supporters for Del Norte Rosevelt Elk and EPIC (4/4/19). We are very concerned that a ratio of 25 bulls, at a minimum, for 100 cows is recommended by the scientific community, but the DFW/FGC arbitrarily or carelessly recommends a reduction of bulls to 15 per 100 cows. Where is the peer-reviewed, scientific studies to support a 40% increase of bull killing?

We submit that such a drastic increase in the killing of bulls, is unacceptable. This is exacerbated when coupled with an apparent non consideration or factoring of maiming, wounding, and/or other subsequent lethal injuries created by failed attempts to kill where the animal is not retrieved. DFW/FGC needs to lean toward the Precautionary Principle and err on the side of caution.

We also agree and support most of the comments submitted by Friends of Del Norte (4/4/19).

One notable exception is: In our opinion, no one group, whether it be a nonprofit, religious, spiritual, conservation, environmental, tribal, political, public agency, or any other type of group or organization should ever be granted special privileges, priorities, or preferences over any other individual member of the public. IF tags are to be issued, they should be available to all, whether their intention is to view (nonconsumptive) or to kill (consumptive).

Free or discounted tags have no place in protecting and preserving the common good or any other resource held in public trust by DFW/FGC. Whether it's subsistence

P.O. Box 671 Loomis, CA 95650 Public-Interest@live.com

food, religious food, and/or additional use of any parts of the animal for any type of spiritual ceremony, medicinal purposes, etc., is irrelevant and not the purview of DFW/FGC. As a public agency, DFW/FGC's role is simply to treat everyone equally and to ensure enforcement of regulations for full compliance is applied equally to all.

Should any member of the public wish to be included in a drawing or allocation of a tag, he/she should not have to buy a license to kill in order to do so. A license to view--not kill--should be available for the same nominal fee that is paid by those who choose to enter the drawing/allocation process. No tags or special allocations should ever be "gifted" to any group or individual, regardless of the purpose. Such a process creates an unacceptable perception of questionable practices and/or conflicts of interest.

Thank you for considering our views,



Marilyn Jasper, Chair

COUNTY OF DEL NORTE

Fish and Game Advisory Commission

Advisory body to the Del Norte County Board of Supervisors on fish, wildlife, recreation, and natural resource issues

981 H Street
Crescent City, CA 95531

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Secretary:
Jaclyn Bennett

President Eric Sklar
California Fish and Game Commission
PO Box 944209
Sacramento, CA 94244-2090

May 2, 2019

Re: Northwestern Elk Zone Tag Quotas
Dear President Sklar,

We are writing in support of the Department of Fish and Wildlife (Department) proposal to increase the Northwestern Elk Zone tag quota range for Roosevelt elk by 20 tags, as described in the Department's 2018 Draft Supplemental Environmental Document (DSED). We are also providing comments regarding the Private Lands Management Program and elk relocation strategies that should be part of the 2018 Elk Conservation and Management Plan (Management Plan) and DSED.

Private Lands Management (PLM) Elk Tags:

The Department has recommended that the number of PLM tags not exceed 50 percent of the general draw tags (Management Plan). We believe that PLM tags should be well below 50 percent of the general draw. In 2018, the PLM tags accounted for 44 percent of the elk harvested in the Northwest California Zone (DSED). The PLM uses up tags within the Northwestern Elk Zone that would otherwise be available for general draw tags. PLM Bull Roosevelt elk tags often sell for tens of thousands of dollars while a Northwestern Elk Zone tag costs $459.25 for a California resident who successfully draws a tag.

Though PLM tags will not increase as a result of the proposed modifications to the current elk hunting regulations (2019-2020) we believe the public, particularly local hunters who apply for elk tags, unfairly lose opportunities to draw an elk tag in the Northwestern Elk Zone. **We understand that the PLM helps landowners alleviate depredation, however it does so at the expense of local hunters who likely can't afford to buy PLM tags.**

Elk Relocation Efforts:

We believe Roosevelt elk-specific relocation criteria, actions and strategies should be called out in the Management Plan and included in the DSED. Relocation of Roosevelt elk does not appear- to be part of the Management Plan even though past relocation efforts are responsible for the success of Roosevelt elk in California. We are concerned that the absence of Roosevelt elk relocation strategies in the Management Plan will preclude any efforts to relocate individual elk and/or herds to Six Rivers National Forest within Del Norte County.

While the Management Plan states that 60 percent of the North Coast Unit is privately owned, Del Norte County is actually mostly publicly owned land (>80 percent) with US Forest Service (Six Rivers National Forest) as the dominant land manager.

Ironically most of the elk in Del Norte County occur on private land and relatively few elk occur on public lands currently open to hunting.

Elk relocation efforts in the 1940s to early 1960s were thought to be unsuccessful. However it is unknown why. From 1982 through 2000 more than 350 elk were translocated to reestablish populations in Humboldt, Mendocino, Siskiyou and Trinity Counties (Management Plan). Since 1985, the Department has translocated more than 280 Roosevelt elk to reestablish populations in portions of southern Humboldt, Mendocino, Siskiyou, and Trinity counties (DSED SCH 2018112037).

The Management Plan states that elk in western Siskiyou County showed the same genetic characteristics as those in Del Norte and Humboldt Counties and that Interstate 5 may be a physical barrier to eastern elk populations. Therefore relocating animals within Del Norte County would have no effect on inland populations (genetics) in California and Oregon. The Six Rivers National Forest in Del Norte County should be included as priority area for Roosevelt elk relocation effort.

The North Coast Unit contains the least amount of habitat loss and fragmentation anywhere in the state. According to the Management Plan, Roosevelt elk populations are growing and expanding within the unit and both current population size and biological carrying capacity are likely much larger than estimated (Management Plan). Del Norte County includes abundant opportunities for reestablishing elk in wide, wildlife corridors within large interconnected regions that can maintain the genetic diversity of healthy populations.

Roosevelt elk are extremely important to Del Norte County for their consumptive, non¬consumptive and intrinsic values. The Management Plan, with respect to the North Coast Unit, must favor the sportsman and include the opportunities to capture and relocate animals in order to alleviate road and private land conflicts and future public consumptive and non-consumptive uses.

We look forward to receiving a response from the Fish and Game Commission.

Sincerely,



Zack Ldrson, Chairman