

DEPARTMENT OF THE INTERIOR**Fish and Wildlife Service****50 CFR Part 17**

[Docket No. FWS-R8-ES-2011-0103;
4500030113]

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List Sierra Nevada Red Fox as an Endangered or Threatened Species

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of 12-month petition finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list Sierra Nevada red fox (*Vulpes vulpes necator*) as an endangered or threatened species under the Endangered Species Act of 1973, as amended (Act). After review of the best available scientific and commercial information, we find that listing the entire Sierra Nevada red fox subspecies is not warranted. We were also petitioned to evaluate two populations within the subspecies' range as potential distinct population segments (DPSs). We find that both the Southern Cascades and Sierra Nevada population segments of the Sierra Nevada red fox meet the Service's DPS policy criteria, and therefore are valid DPSs. After review of the best available scientific and commercial information for these two DPSs, we find that listing the Southern Cascades DPS is not warranted at this time, and listing the Sierra Nevada DPS is warranted. Currently, however, listing the Sierra Nevada DPS is precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants. Upon publication of this 12-month finding, we will add the Sierra Nevada DPS of the Sierra Nevada red fox to our candidate species list. We will develop a proposed rule to list the Sierra Nevada DPS as our priorities allow. We will make a determination on critical habitat during development of the proposed listing rule. In the interim period, we will address the status of the candidate DPS through our annual candidate notice of review (CNOR).

DATES: The finding announced in this document was made on October 8, 2015.

ADDRESSES: This finding is available on the Internet at <http://www.regulations.gov> at Docket Number FWS-R8-ES-2011-0103. Supporting documentation we used in preparing this finding is available for public inspection, by appointment, during

normal business hours at the U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Room W-2605, Sacramento, CA 95825. Please submit any new information, materials, comments, or questions concerning this finding to the above street address.

FOR FURTHER INFORMATION CONTACT: Jennifer Norris, Field Supervisor, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office (see **ADDRESSES**); by telephone at 916-414-6600; or by facsimile at 916-414-6712. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at 800-877-8339.

SUPPLEMENTARY INFORMATION:**Acronyms and Abbreviations Used in This Document**

We use many acronyms and abbreviations throughout this 12-month finding. To assist the reader, we provide a list of these here for easy reference:

Act = Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)
 BWRA = Bridgeport Winter Recreation Area
 CBD = Center for Biological Diversity
 CDFG = California Department of Fish and Game (see below)
 CDFW = California Department of Fish and Wildlife (formerly CDFG)
 CESA = California Endangered Species Act
 CFR = Code of Federal Regulations
 dbh = diameter at breast height
 DNA = deoxyribonucleic acid
 DPS = distinct population segment
 EFF = elokomin fluke fever
 Forest Service = U.S. Forest Service
 FR = Federal Register
 INRMP = integrated natural resources management plan
 IPCC = Intergovernmental Panel on Climate Change
 ISAB = Independent Scientific Advisory Board
 LRMP = land and resource management plan
 MWTC = Marine Warfare Training Center
 mtDNA = mitochondrial deoxyribonucleic acid
 NFMA = National Forest Management Act (16 U.S.C. 1600 *et seq.*)
 NMFS = National Marine Fisheries Service
 NPS = National Park Service
 NWFP = Northwest Forest Plan
 ODFW = Oregon Department of Fish and Wildlife
 OHV = off-highway vehicle
 OPLMA = Omnibus Public Land Management Act (Pub. L. 111-11)
 Service = U.S. Fish and Wildlife Service
 SPD = salmon poisoning disease
 SNFPA = Sierra Nevada Forest Plan Amendment
 SPR = significant portion of [a species'] range
 USDA = U.S. Department of Agriculture
 USDI = U.S. Department of the Interior

Background

Section 4(b)(3)(B) of the Act (16 U.S.C. 1531 *et seq.*) requires that, for

any petition to revise the Federal Lists of Endangered and Threatened Wildlife and Plants that contains substantial scientific or commercial information suggesting that listing a species may be warranted, we make a finding within 12 months of the date of receipt of the petition. In this finding, we will determine that the petitioned action is: (1) Not warranted, (2) warranted, or (3) warranted, but the immediate proposal of a regulation implementing the petitioned action is precluded by other pending proposals to determine whether species are endangered or threatened, and expeditious progress is being made to add or remove qualified species from the Federal Lists of Endangered and Threatened Wildlife and Plants ("warranted but precluded"). Section 4(b)(3)(C) of the Act requires that we treat a petition for which the requested action is found to be warranted but precluded as though resubmitted on the date of such finding, that is, requiring a subsequent finding to be made within 12 months. We must publish these 12-month findings in the **Federal Register**.

Previous Federal Actions

On April 27, 2011, we received a petition dated April 27, 2011, from the Center for Biological Diversity, requesting that Sierra Nevada red fox be listed as endangered or threatened, and that critical habitat be designated under the Act. The petition also requested that we evaluate two populations within the subspecies' range as potential distinct population segments (DPSs) under the Service's DPS Policy: One in the Southern Cascades (south of the Columbia River) and the other in the Sierra Nevada Mountains. The petition clearly identified itself as such and included the requisite identification information for the petitioner, as required by title 50 of the Code of Federal Regulations (CFR) at section 424.14(a). In a May 24, 2011, letter to the petitioner, we responded that we reviewed the information presented in the petition and determined that issuing an emergency regulation temporarily listing the species under section 4(b)(7) of the Act was not warranted. We also stated that we were required to complete a significant number of listing and critical habitat actions in Fiscal Year 2011 pursuant to court orders, judicially approved settlement agreements, and other statutory deadlines, but that we had secured funding for Fiscal Year 2011 to allow publication of a finding in the **Federal Register** in early Fiscal Year 2012.

On January 3, 2012, we published in the **Federal Register** a 90-day finding (77 FR 45) that the petition presented

substantial information indicating that listing may be warranted and that initiated a status review. This notice constitutes the 12-month finding on the April 27, 2011, petition to list the Sierra Nevada red fox as an endangered or threatened species.

This finding is based upon the Species Report titled “Species Report, Sierra Nevada Red Fox (*Vulpes vulpes necator*)” (Service 2015) (Species Report), a scientific analysis of available information prepared by a team of Service biologists from the Service’s Sacramento Fish and Wildlife Office, Yreka Fish and Wildlife Office, Klamath Falls Fish and Wildlife Office, Roseburg Fish and Wildlife Office, Pacific Southwest Regional Office, Pacific Regional Office, and National Headquarters Office. The purpose of the Species Report is to provide the best available scientific and commercial information about Sierra Nevada red fox so that we can evaluate whether or not the subspecies warrants protection under the Act. In it, we compiled the best scientific and commercial data available concerning the status of the subspecies, including past, present, and future stressors. As such, the Species Report provides the scientific basis that informs our regulatory decision in this document, which involves the further application of standards within the Act and its regulations and policies. The Species Report can be found on the Internet at <http://www.regulations.gov>, Docket No. FWS–R8–ES–2011–0103.

Summary of Species Information

A thorough review of the taxonomy, genetics, habitat use, life history, range, distribution, and occurrence information for the Sierra Nevada red fox is presented in the Species Report (Service 2015, pp. 6–14), available on the Internet at <http://www.regulations.gov> under Docket No. FWS–R8–ES–2011–0103; a summary of this information is presented below. We used data specific to the Sierra Nevada red fox when they were available. When such information was lacking, we relied on information regarding other North American red fox subspecies in general, including montane red fox such as Cascade red fox (*Vulpes vulpes cascadiensis*) or Rocky Mountain red fox (*V.v. macroura*), as well as other subspecies of lowland red fox, such as the Sacramento Valley red fox (*V.v. patwin*). We make these distinctions in the text that follows, when applicable.

Sierra Nevada red fox is classified in the mammalian order Carnivora, family Canidae, and is one of 10, 11, or 13 subspecies of red fox recognized in North America by various sources (Hall

1981, p. 938; Larivière and Pashitschniak-Arts 1996, pp. 1–2; Aubry 1997, p. 55; Sacks *et al.* 2010a, pp. 1523, 1535; ITIS 2014, p. 1). The Sierra Nevada red fox can be distinguished from lowland-dwelling red fox subspecies based on its smaller size and use of high-elevation, snow-covered habitat (Roest 1977, p. 13; Perrine *et al.* 2010, p. 5). The Sierra Nevada red fox was first described by Merriam (1900, pp. 662, 664) as the species *Vulpes necator*, but was redesignated as a subspecies of North American red fox (*Vulpes fulva necator*) in 1936 (Bailey 1936, pp. 272, 317), and then as a subspecies of a single red fox species stretching across Europe, Asia, and North America (*Vulpes vulpes necator*) in 1957 (Churcher 1957, p. 202; Churcher 1959, p. 519). The scientific community continues to recognize the Sierra Nevada red fox as a subspecies (Roest 1977, p. 1; Larivière and Pashitschniak-Arts 1996, pp. 1–2; Aubry 1997, p. 55; Sacks *et al.* 2010a, p. 1542). Therefore, we accept the classification of the Sierra Nevada red fox as a subspecies of the red fox. Other red fox subspecies found nearest the Sierra Nevada red fox’s range include the closely related and morphologically similar Cascade red fox (occurring in the Washington Cascades north of the Columbia River (Sacks *et al.* 2010a, pp. 1528, 1536), and the Sacramento Valley red fox (occurring in the Sacramento Valley of California (Sacks *et al.* 2010a, pp. 1523–1524, 1535)). Additionally, descendants of red fox originally imported from eastern and more northern areas of North America into California and Oregon as fur-farm stock (described as “nonnative red fox” herein) reside in lowland areas of California and Oregon (Sacks *et al.* 2010a, pp. 1524).

The red fox is a relatively small canid with an elongated snout, large ears, slender legs and body, and a bushy tail with a white tip (Larivière and Pashitschniak-Arts 1996, p. 2; Aubry 1997, p. 55; Perrine 2005, p. 1; Perrine *et al.* 2010, p. 5). Red foxes typically have primarily red fur, but can also occur in a “cross phase” (primarily grayish-brown, with darker lines along the back and shoulders) or “black phase” (also called the silver phase; primarily black with occasional silver guard hairs) (Aubry 1997, p. 55; Perrine *et al.* 2010, p. 5). Cross and black phases are generally rare, but tend to be more common in cold mountainous areas (Aubry 1997, p. 55; Perrine *et al.* 2010, p. 5).

The Sierra Nevada red fox and two other montane subspecies (*i.e.*, Cascades and Rocky Mountain red foxes) are

characterized by specialized adaptations to cold areas (Sacks *et al.* 2010a, p. 1524). Such adaptations include a particularly thick and deep winter coat (Grinnell *et al.* 1937, p. 377) and small toe pads (4 millimeters (mm) (0.2 inches (in)) across or less) that are completely covered in winter by dense fur to facilitate movement over snow (Grinnell *et al.* 1937, pp. 378, 393; Sacks 2014a, p. 30). The Sierra Nevada red fox and other montane subspecies also tend to be smaller than other red foxes (Perrine *et al.* 2010, p. 5), which may facilitate movement over snow by lowering weight supported per square centimeter of footpad (Quinn and Sacks 2014, p. 17).

Sierra Nevada red fox use multiple habitat types in the alpine and subalpine zones (near and above treeline) (California Department of Fish and Game (CDFG) 1987, p. 3). In addition to meadows and rocky areas (U.S. Department of Agriculture (USDA) 2009, p. 506), Sierra Nevada red fox use high-elevation conifer habitat of various types (Perrine 2005, pp. 63–64). Nearest the treeline in the Lassen sighting area, where habitat use has been best documented, the subspecies frequents subalpine conifer habitat dominated by whitebark pine (*Pinus albicaulis*) and mountain hemlock (*Tsuga mertensiana*) (Perrine 2005, pp. 6, 63–64; California Department of Fish and Wildlife (CDFW) undated, p. 3; Verner and Purcell undated, p. 3). Such conifer habitat has been described as typically “open” (Verner and Purcell undated, p. 1), and “patchy” (Lowden 2015, p. 1). We lack similarly specific habitat descriptions for Oregon.

Sierra Nevada red fox in Oregon, and at the Lassen sighting area in California, have also been found to descend during winter months into high-elevation conifer areas below the subalpine zone (Perrine 2005, pp. 63–64; Aubry *et al.* 2015, p. 1). In the Lassen sighting area, this habitat consists primarily of red fir (*Abies magnifica*), white fir (*Abies concolor*), and lodgepole pine (*Pinus contorta*) (Perrine 2005, pp. 63–64; CDFW undated, p. 3; Barrett 1988, p. 3). Winter sightings have occurred as low as 1,410 m (4,626 ft) in the Lassen sighting area (Perrine 2005, pp. 2, 162), and 1,280 m (4,200 ft) in Oregon (Aubry *et al.* 2015, p. 1). Possible reasons for this elevational migration include lessened snow depths at lower elevations (Perrine 2005, pp. 80, 81), unsuccessful dispersal movements by nonbreeding individuals (Statham *et al.* 2012, p. 130), and lack of suitable prey at high elevations in the Lassen area (Perrine 2005, p. 30). While on these lower winter ranges, the subspecies has

shown a preference for mature closed canopy conifer forests, despite the rarity of this forest structural category (less than 7 percent) in the area studied (Perrine 2005, pp. 67, 74, 90). Similar elevational migrations are not known for the Sonora Pass sighting area (Statham *et al.* 2012, p. 130).

Dispersal distances have not been documented for Sierra Nevada red fox, but one study found juvenile male red foxes in the American Midwest dispersed 30 km (18.6 mi) on average, while juvenile females dispersed an average of 10 km (6.2 mi) (Statham *et al.* 2012, p. 130). A few young American Midwest red foxes (5 percent) dispersed over 80 km (50 mi) in their first year (Statham *et al.* 2012, p. 130).

Although little direct information exists regarding the Sierra Nevada red fox's reproductive biology, there is no evidence to suggest it is markedly different from lowland-dwelling North American red fox subspecies (Aubry 1997, p. 57). Those subspecies are predominately monogamous and mate over several weeks in the late winter and early spring (Aubry 1997, p. 57). The gestation period for North American red fox is 51 to 53 days, with birth occurring from March through May in sheltered dens (Perrine *et al.* 2010, p. 14). Sierra Nevada red fox use natural openings in rock piles at the base of cliffs and slopes as denning sites (Grinnell *et al.* 1937, p. 394). They may also dig earthen dens similar to Cascade red foxes (although this has not been directly documented) (Aubry 1997, p. 58; Perrine 2005, p. 153). Sierra Nevada red fox litters are reported by Grinnell *et al.* (1937, p. 394) to average six pups with a range of three to nine; however, recent evidence suggests that litter sizes of two to three are more typical, and that reproductive output is generally low in montane foxes (Perrine 2005, pp. 152–153).

Home range sizes of Sierra Nevada red fox have not been studied throughout the range of the subspecies. However, Perrine (2005, pp. 2, 159) found within a portion of the Lassen sighting area that adult Sierra Nevada red fox established summer home ranges averaging 2,564 hectares (ha) (6,336 acres (ac)), with individual home ranges ranging from 262 ha (647 ac) to 6,981 ha (17,250 ac) (Perrine 2005, pp. 2, 159). Winter home ranges were larger, averaging 3,255 ha (8,042 ac) and ranging from 326 to 6,685 ha (806 to 16,519 ac) (Perrine 2005, p. 159). Quinn and Sacks (2014, pp. 2, 9, 11) found within a portion of the Sonora Pass sighting area that minimum home range estimates averaged 910 ha (2,249 ac), and were maintained both winter and summer.

The average lifespan, age-specific mortality rates, sex ratios, and demographic structure of Sierra Nevada red fox populations are not known, and are not easily extrapolated from other red fox subspecies because heavy hunting and trapping pressure on those other subspecies likely skew study results (Perrine *et al.* 2010, p. 18). However, one study within a portion of the Lassen sighting area found that three Sierra Nevada red fox lived at least 5.5 years (CDFW 2015, p. 1), and another study within a portion of the Sonora Pass sighting area found the average annual adult survival rate to be 82 percent, which is relatively high for red foxes (Quinn and Sacks 2014, pp. 10, 14–15, 24).

Sierra Nevada red fox appear to be opportunistic predators and foragers, with a diet primarily composed of small rodents, but also including deer carrion (*Odocoileus hemionus*) (particularly in winter and spring) and manzanita berries (*Arctostaphylos nevadensis*) (particularly in fall) (Perrine *et al.* 2010, pp. 24, 30, 32–33). Sierra Nevada red fox are most active at dusk and at night (Perrine 2005, p. 114), when many rodents are most active. High-elevation lagomorphs, such as snowshoe hare (*Lepus americanus*) and pika (*Ochotona princeps*), also are diet components of the subspecies, although they were not an important food source in the Lassen sighting area, possibly due to scarcity in the region (Perrine 2005, pp. 29–30).

Distribution/Range

In 1937, Grinnell *et al.* (1937, pp. 381–382) defined the range of the Sierra Nevada red fox in California as three separate areas: (1) The area of Mt. Shasta, primarily in the Cascades but extending slightly into the Trinity Mountains; (2) in the California Cascades around Lassen Peak; and (3) along the upper elevations of the Sierra Nevada Mountain Range from Tulare to Sierra Counties. A study by Sacks *et al.* (2010a, p. 1536) extended the historical range into the Cascade Mountains of Oregon to the Columbia River. This range includes those mountainous areas that exceed 1,200 m (3,937 ft) in California (Perrine *et al.* 2010, p. 8) and 1,219 m (4,000 ft) in Oregon (Aubry *et al.* 2015, pp. 2–3; Doerr 2015, pp. 2–3, 13–14, line 7). We note that the historical range description for Sierra Nevada red fox provided earlier by Grinnell *et al.* (1937, pp. 381–382) did not include the Oregon Cascades, because it was presumed these montane fox were the Cascades red fox subspecies.

At the time of the 90-day finding (77 FR 45; January 3, 2012), the distribution

of Sierra Nevada red fox was believed to be restricted to two small populations: One in the vicinity of Lassen Peak (Perrine 2005, p. 105; California Natural Diversity Database (CNDDDB) 2011, pp. 54–60) and the other in the vicinity of Sonora Pass (Perrine *et al.* 2010, notes in proof; CNDDDB 2011, pp. 54–60). Both these populations are on Federal lands, with the exception of some small private inholdings in the Lassen area. Systematic carnivore surveys conducted from 1996 to 2002 throughout the Sierra Nevada and Cascades Mountains of California did not detect any Sierra Nevada red fox (Zielinski *et al.* 2005, pp. 1385, 1387), indicating the subspecies was likely extirpated or in low densities in the regions sampled; according to Figures 1 and 3 in Zielinski *et al.* (2005, pp. 1387, 1389), the currently known Lassen sighting area was within the 1996–2002 sampling area. The population levels of Sierra Nevada red fox at that time were unknown, but the subspecies was believed to occur at very low density (Perrine *et al.* 2010, p. 9).

Following publication of our 90-day finding in the **Federal Register** (77 FR 45; January 3, 2012), the Sierra Nevada red fox's range has been confirmed (via a combination of genetics and photographic evidence) to extend into the Oregon Cascades (Figure 1, below) as far north as Mt. Hood, significantly extending the subspecies' range beyond its historically known range in California. Specifically, five sighting areas (*i.e.*, clustered locations of recent Sierra Nevada red fox sightings) have been identified on Federal lands in Oregon where surveys have occurred, in addition to the two known sighting areas in California as described in the 90-day finding (77 FR 45). Sierra Nevada red fox are thus known from a total of seven sighting areas, located in the vicinity of (north to south) Mt. Hood, Mt. Washington, Dutchman Flat, Willamette Pass, and Crater Lake in Oregon; and Lassen and Sonora Pass in California (Figure 1, below). The two California sighting areas were known in the 1930s to be occupied by Sierra Nevada red fox (Grinnell *et al.* 1937, pp. 381–382) and were found to still be occupied in 1993 and 2010 (Perrine 2005, pp. 4, 167–168; Statham *et al.* 2012, p. 123). The five Oregon sighting areas were first identified in 2012 and 2013, after publication of our 90-day finding (77 FR 45). Additional sightings within the current Oregon sighting areas have been reported as recently as 2014 (*e.g.*, Doerr 2015, pp. 1, 8, 11–14), and surveys in portions of the subspecies' range are ongoing.

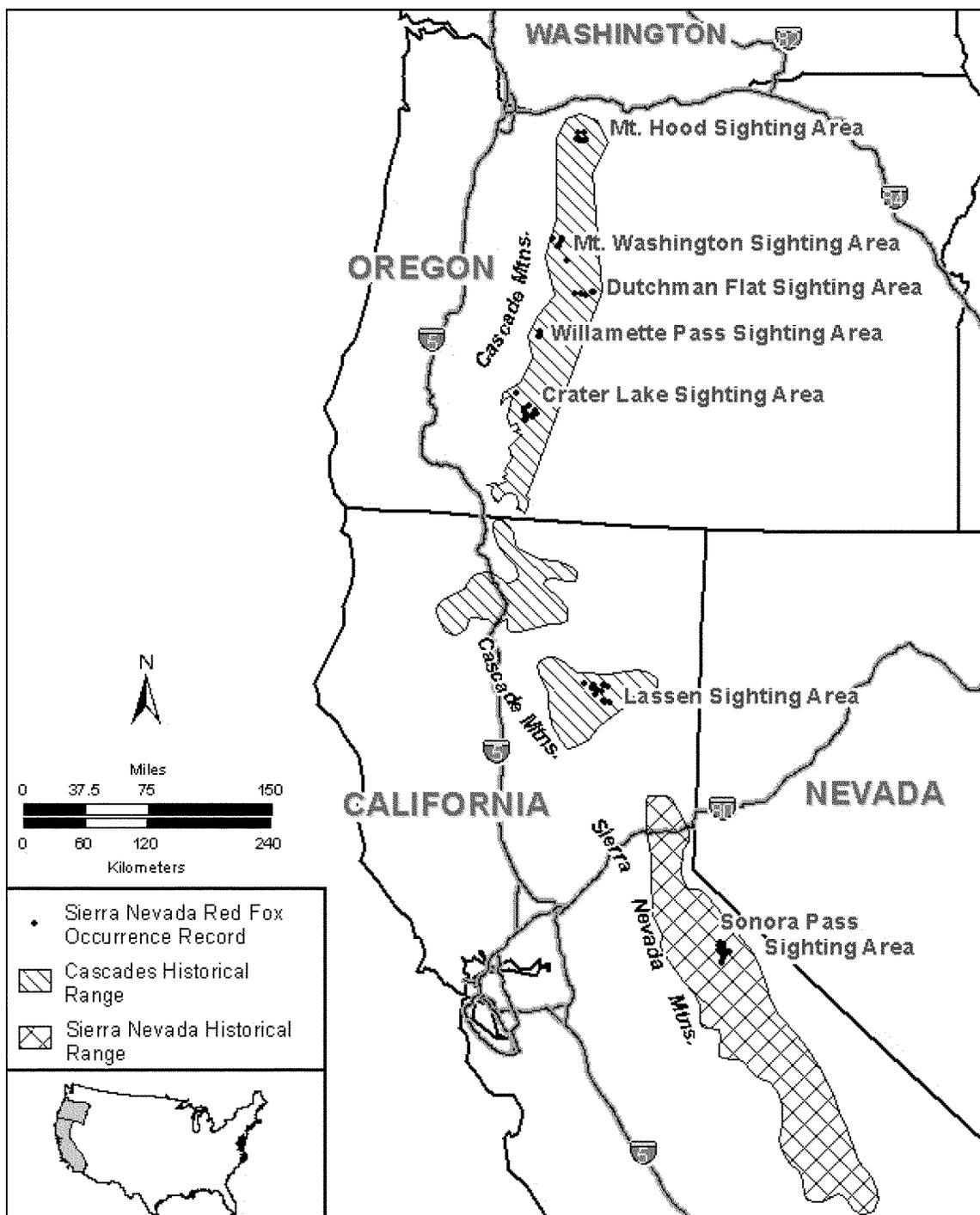


Figure 1—Historical range and sighting areas of Sierra Nevada red fox (*Vulpes vulpes necator*) from recent records (2000–2015). The historical range in Oregon is derived from Sacks *et al.* (2010a, p. 1536), who determined that museum specimens of Oregon montane red foxes were Sierra Nevada red fox. The historical range in California is based on Perrine *et al.* (2010, p. 4), which is based on Grinnell *et al.* (1937, p. 382).

It is possible that Sierra Nevada red foxes may occur in additional areas beyond the seven specific sighting areas described above, particularly in the Oregon Cascades within any areas of suitable habitat that have not been

surveyed, or have been surveyed only sporadically.

Population/Abundance Information

Based on interviews with trappers, Grinnell *et al.* (1937, p. 390) described

Sierra Nevada red fox population numbers as “relatively small, even in the most favorable territory,” and reported that Sierra Nevada red fox likely occurred at densities of 1 per 2.6 square km (1 per square mi). Perrine *et*

al. (2010, p. 9) concluded from this that Sierra Nevada red fox likely occur at low population densities even within areas of high relative abundance.

Historical trapping information in California from CDFW and Schempf and White (1977, p. 44) indicates that the numbers of Sierra Nevada red fox numbers trapped in California fell considerably in the mid-1900s as compared to trapping data reported by Grinnell *et al.* (1937, p. 389). The average annual harvest of Sierra Nevada red fox pelts in California declined from the 1920s (21 pelts per year) to the 1940s and 1950s (6.75 pelts per year) (Grinnell *et al.* 1937, p. 389; Perrine 2005, p. 154). Sightings became rare

after the 1940s (about twice per year in the 1950s and 1960s) (Schempf and White 1977, p. 44). The reduced harvest and sightings of Sierra Nevada red fox in California led to a prohibition on red fox trapping throughout the State in 1974, and to listing the subspecies as threatened under the California Endangered Species Act (CESA) in 1980 (Statham *et al.* 2012, p. 123). We note that fur trapping for red fox (regardless of the subspecies or origin) in Oregon remains legal Statewide.

Information (both historical and current) is not available regarding the abundance or trends of Sierra Nevada red fox populations in Oregon, particularly given the very recent

discovery of this subspecies' occupation at multiple sighting areas within the Oregon Cascades. However, the best available information since the 90-day finding (77 FR 45; January 3, 2012) indicates multiple individuals have been identified in five sighting areas (5 genetic records and 10 photographic records at Mt. Hood; 1 to 4 records each at the remaining four Oregon sighting areas) (Table 1, below). Surveys are ongoing in the Oregon portion of the subspecies' range, and we anticipate additional sightings and individuals to be identified with continued surveys in suitable habitat areas.

TABLE 1—CURRENT KNOWN SIGHTING AREAS OF SIERRA NEVADA RED FOX IN OREGON AND CALIFORNIA [north to south]

Location ¹	State	County	Primary land owners ²	Estimated population size
Mt. Hood	OR	Clackamas and Hood River.	Mt Hood National Forest	Unknown.
Mt. Washington	OR	Linn, Jefferson, and Deschutes.	Willamette and Deschutes National Forests	Unknown.
Dutchman Flat	OR	Deschutes	Deschutes National Forest	Unknown.
Willamette Pass	OR	Lane	Willamette National Forest	Unknown.
Crater Lake	OR	Klamath and Douglas ...	Crater Lake National Park, Rogue River-Siskiyou National Forest, Fremont-Winema National Forest.	Unknown.
Lassen	CA	Lassen, Plumas, and Tehama.	Lassen National Forest and Lassen Volcanic National Park.	42 adults (21 breeding, 21 non-breeding ³)
Sonora Pass	CA	Tuolumne, Mono, and Alpine.	Toiyabe portion of the Humboldt-Toiyabe National Forest, Stanislaus National Forest, and Yosemite National Park.	29 adults (14 breeding, 15 non-breeding ⁴)

¹ The number of Sierra Nevada red fox sighting areas may not be the same as the actual number of populations. Researchers have not yet determined the precise number or locations of Sierra Nevada red fox populations that reside in the Oregon Cascades.

² Land ownership for known sighting areas is based on surveys that have primarily occurred to date on Federal lands. It is likely that Sierra Nevada red fox reside within contiguous, suitable habitat on intervening or adjacent private/public lands where surveys have not yet occurred.

³ Twenty-one breeding adults, with 95 percent confidence interval of 13 to 34 (Sacks *et al.* 2010a, pp. 1532, 1536–1537). Twenty-one non-breeding adults (estimated range of 0 to 42, based on rough estimates of ratios of nonbreeders to breeders in other red fox subspecies) (Sacks 2015, pp. 1–2).

⁴ Fourteen breeding adults (estimated range 10 to 20) (Sacks *et al.* 2015, pp. 3, 14). Fifteen nonbreeding adults (estimated range of 0 to 30, based on rough estimates of ratios of nonbreeders to breeders in other red fox subspecies) (Sacks 2015, pp. 1–2; Sacks *et al.* 2015, p. 14).

The best available information for the Sierra Nevada red fox sighting areas (north to south) is summarized below. More information is available for the Lassen and Sonora Pass sighting areas because they have been studied more thoroughly, and over a longer time.

- *Mt. Hood sighting area*—This sighting area includes the general vicinity surrounding Mt. Hood. Lands within this sighting area are owned and managed by Mt. Hood National Forest. Approximately 15 sightings of Sierra Nevada red fox (consisting either of photographs or genetically tested scat or hair) have been made in the area, and three individuals have been distinguished from the Mt. Hood sighting area (Akens 2014, entire; Akens and Sacks 2014, entire; Akens and Sacks

2015, p. 1). At this time, there are no empirical data on which to base an estimate of either current population(s) abundance or trend of Sierra Nevada red fox within this sighting area.

- *Mt. Washington, Dutchman Flat, Willamette Pass, and Crater Lake sighting areas*—Lands within these sighting areas are owned and managed by: (1) Willamette and Deschutes National Forest (Mt. Washington); Deschutes National Forest (Dutchman Flat); Willamette National Forest (Willamette Pass); and Crater Lake National Park, and Rogue-River-Siskiyou and Fremont-Winema National Forests (Crater Lake). At this time, similar to the Mt. Hood sighting area, there are no empirical data on which to base an estimate of either current

population(s) abundance or trend of Sierra Nevada red fox within these sighting areas.

- *Lassen sighting area*—This sighting area includes lands managed by Lassen National Forest and Lassen Volcanic National Park (including the Caribou Wilderness), and some private inholdings primarily as timberlands (CDFW 2015, p. 1). Sacks *et al.* (2010a, pp. 1532, 1536–1537) estimated that the effective size of the population at the Lassen sighting area (referred to in the study as the modern Southern Cascades population) is 21 breeding individuals, with a 95 percent confidence interval of 13 to 34 breeding individuals (see also Statham *et al.* 2012, pp. 122, 123). The “effective size” of the population refers to the number of breeding individuals in

an “ideal” population (with discreet, non-overlapping generations, equal contribution of all members to the next generation, and free mixing prior to mate choice) that experiences the same amount of genetic drift (random change in gene frequencies) as the actual population (Lande and Barrowclough 1987, pp. 88–89). Actual Sierra Nevada red fox populations are likely to be somewhat larger than their effective population sizes because they include non-breeding individuals, including pups, and (possibly) adult offspring remaining on their parent’s territory to help raise their siblings. Such “helpers” are not uncommon in other red fox subspecies, though clear evidence of them has not been demonstrated in Sierra Nevada red fox (Wildlife Online 2015, p. 60; Sacks 2015, pp. 1–2). A high-end estimate of actual population size for the Lassen sighting area might therefore assume two non-breeders for every breeder, resulting in a total population of about 63 individuals (Sacks 2015, p. 2).

CDFW obtained 187 Sierra Nevada red fox scat and hair samples from the Lassen sighting area between 2007 and 2013, and was able to genetically identify 18 separate individuals from those samples (CDFW 2015, p. 1), thereby tending to support the low effective population size estimate (*i.e.*, 21 breeding individuals) of Sacks *et al.* (2010a, p. 1532). CDFW was also able to identify the source individuals for over 100 Sierra Nevada red fox genetic samples collected within the Caribou Wilderness (immediately east of Lassen Volcanic National Park within the sighting area) in 2012 and 2013, finding that no new individuals (*i.e.*, offspring) entered the population within the study area during those years (CDFW 2015, p. 2). Thus, successful reproduction in that portion of the sighting area during those years was low or nonexistent. However, CDFW cameras did photograph a Sierra Nevada red fox near the Caribou Wilderness in 2009 that appeared visibly pregnant (CDFW 2015, p. 2).

- *Sonora Pass sighting area*—This sighting area includes the general vicinity surrounding Sonora Pass, which includes lands that are owned and managed by Humboldt-Toiyabe National Forest, Stanislaus National Forest, and Yosemite National Park. The Sonora Pass sighting area includes several multi-year Sierra Nevada red fox residents (Quinn and Sacks 2014, p. 2), and so may be considered a population site rather than merely a dispersal area from some undiscovered population. Researchers (Sacks *et al.* 2015, p. 3) conducting a 3-year study in a portion of the sighting area from October 2011

through September 2014 used genetic tests to identify eight individuals. With the exception of a female killed on U.S. Highway 395, possibly while dispersing, all Sierra Nevada red fox sightings were found within an area of 13,000 ha (32,124 ac), extending both north and south from California State Route 108, within 3 km of the Sierra Crest (Quinn and Sacks 2014, p. 10). This study area constituted 20 to 50 percent of the contiguous high-quality habitat for the subspecies in the region (Quinn and Sacks 2014, p. 14), with the remainder of the high-quality habitat primarily extending south into the northern portion of Yosemite National Park (Quinn and Sacks 2014, pp. 10, 36). Thus, the Sacks *et al.* (2015, entire) study area south into the northern portion of Yosemite National Park is what we have roughly defined as the Sonora Pass sighting area. However, we note that this sighting area has been poorly surveyed for Sierra Nevada red fox due to rough terrain. It is likely that the data obtained by Quinn and Sacks (2014, entire) is representative of the entire population in the region because the area studied was of high quality habitat similar to the rest of the high quality habitat in the region (Quinn and Sacks 2014, p. 14), and because the area studied was large enough to support the assumption that the Sierra Nevada red fox included in the study were representative of the larger population (Quinn and Sacks 2014, pp. 10, 14).

Based on the extent of suitable habitat in the Sonora Pass sighting area, and on the number of adult Sierra Nevada red fox per hectare in the surveyed portion of the habitat at any given time (usually six adults in 13,000 ha (32,124 ac)), Quinn and Sacks (2014, pp. 3, 11, 14) estimated the total number of adult Sierra Nevada red fox in the entire Sonora Pass sighting area to be 14, with a likely range of 10 to 20. Repeated resampling of individuals over the 3-year study period (2011 through 2014) suggests that most adults with territories overlapping the study area were found (Quinn and Sacks 2014, p. 14). However, Quinn and Sacks (2014, pp. 11, 14; Sacks 2015, p. 1) indicated their estimates were “crude,” and that the total number of adults in the population could possibly be as high as 50 due to the presence of nonbreeding helpers at natal den sites.

Low population size estimates for the Sonora Pass sighting area were also supported by analyses of genetic diversity (Quinn and Sacks 2014, pp. 13–14). For instance, the average heterozygosity (a measure of genetic diversity) in nuclear deoxyribonucleic acid (DNA; from the cell nucleus) for

Sierra Nevada red fox (0.44) was lower than at the Lassen sighting area (0.53), suggesting that the population size at the Sonora Pass sighting area may be smaller (Quinn and Sacks 2014, pp. 13–14). Current heterozygosity levels at the Sonora Pass sighting area are also considerably lower than heterozygosity levels present historically (0.64), thus indicating a negative trend in population size (Quinn and Sacks 2014, pp. 13–14). Reductions in the diversity of mitochondrial DNA (mtDNA) since historical times also indicate a decline in population numbers (Quinn and Sacks 2014, p. 14).

Sacks *et al.* (2015, pp. 3, 9) found no evidence to indicate that any Sierra Nevada red fox successfully produced surviving, non-hybrid pups during their 3-year period within the study area at the Sonora Pass sighting area. However, two adult females were determined genetically to be the daughters of a known breeding Sierra Nevada red fox pair (Sacks *et al.* 2015, pp. 3, 9). Additionally, we note that hybridization of Sierra Nevada red fox with nonnative red fox is also known to occur within this small population (see *Hybridization With Nonnative Red Fox*, below).

Summary of Information Pertaining to the Five Factors

Section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR 424) set forth procedures for adding species to, removing species from, or reclassifying species on the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be an endangered or threatened species based on any of the following five factors:

- (A) The present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) Overutilization for commercial, recreational, scientific, or educational purposes;
- (C) Disease or predation;
- (D) The inadequacy of existing regulatory mechanisms; or
- (E) Other natural or manmade factors affecting its continued existence.

In making this finding, information pertaining to the Sierra Nevada red fox in relation to the five factors provided in section 4(a)(1) of the Act is discussed below. In considering what factors might constitute threats to a species, we must look beyond the mere exposure of the species to a particular factor to evaluate whether the species may respond to that factor in a way that causes actual impacts to the species. If there is exposure to a factor but no response, or only a positive response,

that factor is not a threat. If there is exposure and the species responds negatively, the factor may be a threat and we then attempt to determine if that factor rises to the level of a threat, meaning that it may drive or contribute to the risk of extinction of the species such that the species warrants listing as an endangered or threatened species as those terms are defined in the Act. However, the identification of factors that could impact a species negatively is not sufficient to compel a finding that the species warrants listing. The information must include evidence sufficient to suggest that these factors are operative threats that act on the species to the point that the species meets the definition of an endangered or threatened species under the Act.

An analysis of the potential threats for the Sierra Nevada red fox is included in the Species Report (Service 2015, entire) associated with this document (and available at <http://www.regulations.gov> under Docket No. FWS-R8-ES-2011-0103). All potential threats (identified in the Species Report as “stressors” or “potential stressors”) of which we are aware that may be acting upon the Sierra Nevada red fox currently or in the future (and consistent with the five listing factors identified above) were evaluated and addressed in the Species Report, and are summarized in the following paragraphs.

The following sections include summary evaluations of nine potential threats to the Sierra Nevada red fox that may have low or medium-level impacts on the subspecies or its habitat. Potential threats that may impact the subspecies in Oregon and California are those actions that may affect individuals or sighting areas either currently or in the future, including: Wildfire and fire suppression (*Factors A and E*); climate change (*Factor A*); hunting and trapping (*Factor B*); disease, to include salmon poisoning disease (SPD), elokomin fluke fever (EFF), and potentially mange, distemper, or rabies) (*Factor C*); competition and predation by coyotes, which could be exacerbated in the future dependent on climate change impacts to habitat (*Factors C and E*); predation by domestic dogs (*Factor C*); hybridization with nonnative red fox (*Factor E*); vehicles (*Factor E*); and small population size and isolation, specifically for the Lassen and Sonora Pass sighting areas (*Factor E*). We also note that potential impacts associated with logging/vegetation management and grazing were evaluated but found to result in low or no impacts, overall, across the subspecies’ range (see Service 2015, pp. 23–27, 30–32).

To provide a temporal component to our evaluation of potential stressors (*i.e.*, impacts into the future), we first determined whether we had data available that would allow us to reasonably predict the likely future impact of each specific stressor over time. Overall, we found that, for all potential stressors, the likelihood and severity of future impacts became too uncertain to address beyond a 50-year timeframe. For example:

- Logging and grazing impacts on National Forest lands are largely regulated by the Northwest Forest Plan (NWFP) and the Sierra Nevada Forest Plan Amendment (SNFPA). These governing regulations were first adopted in 1994 and 2004, respectively, but the primary impetus for their adoption was the question of how best to carry out logging, grazing, and vegetation management actions in a manner that is sustainable over the long term and that is consistent with applicable laws, including the Multiple Use—Sustained Yield Act of 1960, the Endangered Species Act, and the Federal Land Policy and Management Act of 1976 (USDA 1994, p. 5). As these governing laws have remained in place for 40 to 50 years, and an important management goal under those laws has been “long-term sustainability” (USDA and USDI 1994, p. 5), we consider 50 years a reasonable timeframe for considering future impacts.

- Laws governing hunting and trapping of red foxes in California and Oregon have remained largely unchanged since 1974 and 1978, respectively (CDFG 1987, p. 4; Oregon Department of Fish and Wildlife (ODFW) 2011, p. 26); thus, we consider regulatory mechanisms sufficiently stable to support a 50-year timeframe.

- In analyzing potential impacts from disease, small isolated populations, hybridization, coyote competition, and vehicles, we considered all available information regarding any future changes that could alter the likelihood or extent of impacts. We had no such information extending beyond a 50-year timeframe.

- Although information exists regarding potential impacts from climate change beyond a 50-year timeframe, the projections depend on an increasing number of assumptions, and thus become more uncertain with increasingly large timeframes. Therefore, a timeframe of 50 years is used to provide the best balance of scope of impacts considered, versus certainty of those impacts.

Each potential stressor was evaluated to determine the likely impact to Sierra Nevada red foxes or their habitat. The

Species Report describes impacts using the following general categories:

- A low-level impact indicates a stressor is impacting individual Sierra Nevada red fox currently or in the future, or a stressor is resulting in a minor amount of habitat impacts or possibly temporary habitat impacts currently or in the future.
- A medium-level impact indicates a stressor is impacting Sierra Nevada red fox at the population (or sighting area) level currently or in the future, or a stressor is resulting in more serious impacts to suitable habitat at the population (or sighting area) level currently or in the future.
- A high-level impact indicates a stressor is significantly impacting Sierra Nevada red fox at the subspecies level currently or in the future, or a stressor is causing significant impacts to suitable habitat at the subspecies level currently or in the future.

Competition With Coyotes

Both coyotes and Sierra Nevada red foxes are opportunistic predators with considerable overlap in food consumed (Perrine 2005, pp. 36–37). Perrine (2005, pp. 84, 105) suggests that competition with coyotes (*Factor C*), as well as predation as described below, is likely a primary reason why the range of Sierra Nevada red fox is restricted to such high elevations. Any competition likely varies in intensity with prey availability, specifically including in the Lassen sighting area where competition may be stronger during winter months when Sierra Nevada red fox descend in elevation. See the *Predation by Domestic Dogs or Coyotes* section, below, and *Summary of Species Information* section, above, for additional discussion and background information on Sierra Nevada red fox/coyote interactions.

Coyotes occur throughout the current range of the Sierra Nevada red fox, but typically at lower elevations during winter and early spring when snowpacks are high. If snowpacks are reduced in area due to climate change, coyotes would likely encroach into high-elevation areas during early spring when Sierra Nevada red fox are establishing territories and raising pups. Even in the absence of direct predation, the tendency of coyotes to chase off red foxes generally, and to compete with Sierra Nevada red fox for prey, may interfere with the ability of the subspecies to successfully raise offspring (Service 2015, pp. 48–51).

Coyotes were rare or nonexistent in the Oregon Cascades prior to about 1930, but their numbers increased after that time due to the extirpation of gray

wolves (*Canis lupus*), which is a species that tends to compete with and help control coyote population numbers as opposed to impacting smaller species like red fox (Toweill and Anthony 1988, p. 507). Coyote populations also benefitted from clearcutting, which left numerous forest openings in which productivity of berries and prey species was increased (Toweill and Anthony 1988, p. 511); however, timber practices today are much improved compared to those used in the past, in large part due to the NWFP and beneficial management operations as outlined in the National Forests LRMPs. Coyote numbers may also be controlled to an unknown degree into the future given the recent establishment of two packs of the federally endangered gray wolf in the southern Cascades between the Crater Lake and Lassen sighting areas, and likely future growth of these packs or establishment of additional wolf packs. Restoration of wolves to the Cascades in sustainable populations would likely lower coyote population numbers or exclude them from higher elevation forested areas, thereby facilitating the persistence of Sierra Nevada red fox populations (Levi and Wilmers 2012, p. 926); wolves are unlikely to compete heavily with Sierra Nevada red fox because they tend to take larger game (ODFW 2015, p. 8).

Overall, the potential increase of coyote competition as it relates to shifting or modified habitats, or diminished snowpack levels from potential climate change impacts, may still occur throughout the range of the subspecies. The best available data indicate presence of coyotes at the same elevations as Sierra Nevada red fox during certain times of the year; however, there is no information to indicate any population-level impacts. Coyote populations in the southern Cascades sighting areas might not grow over the next 50 years given a decrease in clearcutting as compared to historical timber activity, continued presence of snowpacks at high-elevation areas that are not favorable to coyotes, and the presence and potential increase in wolf presence in Oregon and northern California. As a result, based on the information presented above and in the Species Report (Service 2015, pp. 48–51), the best available data indicate that the impact of coyote competition with Sierra Nevada red fox may occur across the subspecies' range at similar levels (*i.e.*, potential impacts to individuals) into the future, although potentially to a lesser degree in the southern Cascades. Similar to the potential impacts resulting from coyote predation (see

Predation by Domestic Dogs or Coyotes, below), there may be an overall medium-level impact on the subspecies (*i.e.*, impacts to multiple populations). However, this stressor does not rise to the level of a threat currently or in the future because information indicates coyote presence (and potential competition) is likely occurring within portions of most of the sighting areas, and the best available data indicate, at most, potential impacts to individuals. Also, information indicates that coyote populations occurring in the southern portion of the Cascade Range in Oregon and California may be naturally controlled as a result of the current wolf packs that are likely to increase in size into the future, thus decreasing the likelihood of coyotes causing a subspecies-level impact on the Sierra Nevada red fox.

Wildfire and Fire Suppression

Wildfires may impact Sierra Nevada red fox by modifying suitable habitat that the subspecies relies on for multiple aspects of its life history (*e.g.*, reducing denning habitat, reducing or eliminating habitat conditions that support an adequate prey base) (*Factor A*). In general, wildfires in western States, including California and Oregon, have been more frequent, larger, and more intense in the past 50 years, and particularly in the past 15 years (Independent Scientific Advisory Board (ISAB) 2007, pp. 22–23). These increases are directly correlated with climate change (ISAB 2007, pp. 22–23; USDA 2004, p. 6) (see *Climate Change*, below), and are likely to continue. Long-term habitat changes caused by wildfires acting in concert with increased temperatures and altered moisture regimes could possibly result in tree mortality or long-term removal of forested habitat that the subspecies relies on.

Wildfire could also potentially impact individual Sierra Nevada red fox directly through mortality (*Factor E*). However, fires generally kill or injure a relatively small proportion of animal populations, particularly if they are mobile (Lyon *et al.* 2000, pp. 17–20), and the best available data do not indicate that wildfire is causing loss of individual Sierra Nevada red fox. If direct mortality of individual Sierra Nevada red fox occurs, we expect the impact to be discountable because the subspecies is capable of rapid evacuation from an approaching fire, and adequate suitable habitat exists adjacent to the existing sighting areas to establish a new home range (provided the majority of the suitable habitat within the sighting area vicinity is not

subjected to an overly large, high-severity wildfire). However, there are no reports of direct mortality to red foxes, including the Sierra Nevada subspecies, from fires (Tesky 1995, p. 7).

Fire suppression can change suitable habitat conditions for the Sierra Nevada red fox to denser stands of trees with fewer open meadow or shrub areas, thereby potentially reducing the prey base for the subspecies (*Factor E*). Fire suppression could also lead to direct effects on Sierra Nevada red fox by allowing greater fuel buildup, thereby producing larger and hotter wildfires. Researchers (Miller 2003, p. 379; Truex and Zielinski 2013, p. 85) indicate that potential current and future concerns are associated with historical policies of wildfire suppression in western North America that have led to unnatural fuel accumulations and an increased risk of uncharacteristically severe wildfires, which may also be the case specifically within the Sierra Nevada red fox's range.

Although wildfire and fire suppression have the potential to result in negative impacts to Sierra Nevada red fox or their habitat, short-term habitat impacts from all but the largest fires can also benefit Sierra Nevada red foxes by encouraging growth of grasses and shrubs, which in turn lead to increases in small mammal populations preyed on by the subspecies (Tesky 1995, p. 7), as well as increases of fruiting shrubs that are an important supplementary food source (Tesky 1995, p. 8; Perrine 2005, p. 191). These benefits, coupled with active vegetation or management strategies that help reduce hazardous fuel accumulations (such as those strategies outlined in the SNFPA, NWFP, and LRMPs, the latter of which include the Mt. Hood, Willamette, Deschutes, Umpqua, Winema, Rogue River, Klamath, Shasta-Trinity, Lassen, Tahoe, El Dorado, Stanislaus, Sierra, Inyo, Sequoia, and Humboldt-Toiyabe National Forest LRMPs within the range of the subspecies) could have the greatest impact on Sierra Nevada red fox. Additionally, wildfire is not a major disturbance of habitat within the range of the Sierra Nevada red fox, primarily due to the subspecies' residence at high-elevation areas of the Cascades and Sierra Nevada. Recent wildfires have occurred in portions of the Mt. Hood (2011 Dollar Lake fire), Dutchman flat (2012 Pole Creek fire), Lassen (2012 Reading fire), and Sonora Pass (2013 Rim fire) sighting areas. These wildfires are not expected to have permanent, long-term impacts that would prevent the subspecies from remaining or returning to these areas. For example, following the 2012 wildfire at

Dutchman Flat (which was a stand-replacing wildfire), Sierra Nevada red fox were recently detected within the fire perimeter at two locations (McFadden-Hiller and Hiller 2015), indicating minimal impacts to the subspecies given the short time period between the wildfire and the recent 2014 detections in this sighting area.

Based on the analysis contained within the Species Report and summarized above, we expect an increased risk of wildfire overall, and the recent occurrence of such fires at or near various Sierra Nevada red fox sighting areas impacts the subspecies' habitat, at least minimally, for periods of few to several years. The prevalence of such fires is likely to increase in the future due to climate change (see *Climate Change*, below). However, there are no reports of direct mortality to red foxes from wildfires, and wildfires can improve habitat for red foxes by removing competing vegetation and encouraging production of grasses and shrubs favored by small mammals (Tesky 1995, p. 7), which the Sierra Nevada red fox depends upon as a prey base. Accordingly, these potential impacts are balanced with the potential benefits, thus resulting in our consideration of wildfire and fire suppression to constitute a low-level impact that does not rise to the level of a threat either currently and into the future.

Climate Change

"Climate" refers to the mean and variability of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (Intergovernmental Panel on Climate Change [IPCC] 2013, p. 1,450). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2013, p. 1,450). A recent synthesis report of climate change and its effects is available from the IPCC (IPCC 2014, entire).

Changes in climate may have direct or indirect effects on species (*Factor A*). These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables (e.g., habitat fragmentation, fire frequency) (IPCC 2007, pp. 8–14, 18–19). Typically, expert judgment and appropriate analytical approaches are

used to weigh relevant information, including uncertainty, in various aspects of climate change.

Global climate projections are informative, and in some cases, the only scientific information available. However, projected changes in climate and related impacts can vary substantially across and within different regions of the world (e.g., IPCC 2007, pp. 8–12). Therefore, we use "downscaled" projections (see Glick *et al.* 2011, pp. 58–61, for a discussion of downscaling) when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given taxon. For this analysis across the range of the Sierra Nevada red fox, downscaled projections are used in addition to some California and Pacific Northwest regional climate models, which generally encompass a range of sensitivities to low-emission and medium- to high-emission scenarios. The differences between higher- and lower-emissions scenarios are minimal in the next few decades, but become increasingly pronounced after the mid-21st century (Mote and Salathé 2010, p. 39; Cayan *et al.* 2009, p. 7). However, the current emissions trajectory is higher than any of the emissions scenarios used in climate projections for California and the Pacific Northwest (Hansen *et al.* 2013, pp. 1–2). Therefore, the projections we discuss here may underestimate the potential effects of climate change.

All simulations project a larger increase in temperature across the analysis area over the 21st century than occurred during the 20th century. Projections for temperature increases across the analysis area range from 1 °Celsius (C) to 3 °C (1.8 °Fahrenheit (F) to 5.4 °F) by mid-century and from 2 °C to 5.8 °C (3.6 °F to 10.4 °F) by late in the 21st century (Mote *et al.* 2013, p. 34; Pierce *et al.* 2013, p. 844; Cayan *et al.* 2012, p. 4; Halofsky *et al.* 2011, p. 14; Mote and Salathé 2010, p. 41; Hayhoe *et al.* 2004, p. 12423).

Over the past 50 years, warming temperatures have led to a greater proportion of precipitation falling as rain rather than snow, earlier snowmelt, and a decrease in snowpack throughout the western United States (Kapnick and Hall 2010, pp. 3446, 3448; Halofsky *et al.* 2011, p. 21). The consequent lengthening of summer drought and associated increases in mean annual temperature have, in recent decades, caused increased tree mortality rates in mature conifer forests in the range of the SNRF (van Mantgem *et al.* 2009, pp.

522–523). In addition to increased tree mortality, water deficit from climate change is also expected to decrease seedling establishment and tree growth in many currently forested areas, thereby altering tree species distributions (Littell *et al.* 2013, p. 112). Montane scrub communities, which require less water, may tend to increase, thereby decreasing and isolating areas of appropriate habitat for the subspecies. For example, soil types at higher elevations may not support dense forests with a 40 percent or greater canopy cover (Fites-Kaufman *et al.* 2007, pp. 457–458). Thus, this type of vegetation change/shift could lead to greater competition and predation from coyotes (which are better adapted to drier and warmer conditions; see *Competition with Coyotes*, above). Potential shifts in future vegetation type may lead to range shifts for the Sierra Nevada red fox in some localities, although information is not available to indicate precisely where nor how rapidly this may occur. It is important to note that studies of climate change present a range of effects, although conditions are not expected to change to a degree that would be considered significant within the next 50 years. Overall, it is not clear how finer-scale abiotic factors may shape local climates and influence local vegetation trends either to the benefit or detriment of Sierra Nevada red fox, nor is the timeframe clear over which these influences may be realized.

The Sierra Nevada red fox's currently suitable habitat may also be affected by climate change with relation to reduced snowpack, which in turn could result in habitat conditions more suitable for coyotes, thus potentially increasing the level of competition from or predation by coyotes. This is discussed in more detail in the *Predation by Domestic Dogs or Coyotes* (above), *Competition With Coyotes* (above), and *Cumulative Effects* (below) sections. In general, given the best available information, we expect coyotes to remain throughout the Sierra Nevada red fox's range, but we do not expect coyote populations to grow over the next 50 years based on the current and past best available information regarding coyote presence. The potential for coyote competition or predation exists, and it may possibly increase as it relates to shifting habitats from potential climate change impacts. However, any increase would likely be minimal into the future given the continued presence of snowpack at high-elevation areas over the next 50 years. Additionally, it is probable that the presence of wolves (which are likely

to compete with coyotes but not Sierra Nevada red fox (see *Competition With Coyotes* (above)) could be reduced currently and into the future particularly in areas with newly established wolf packs (such as the two wolf packs currently known to occur between the Crater Lake and Lassen sighting areas in the Southern Cascades).

Overall, studies of climate change present a range of effects on vegetation and snowpack levels, including those that indicate conditions are likely to remain suitable for Sierra Nevada red fox throughout its range into the next 50 years. It is also probable that the severity of potential impacts to Sierra Nevada red fox habitat will likely vary across the range, with effects to the subspecies potentially ranging from negative to neutral. The most significant potential future impact is reduced snowpack levels that in turn could make Sierra Nevada red fox habitat more suitable to coyotes and thus cause the fox to shift up in elevation to remain in higher snowpack areas. If this occurs, it would likely pose the greatest risks to the subspecies at the Sonora Pass sighting area because the currently occupied area is relatively small, with a narrow elevational range, and the subspecies is already occupying the highest elevations in the area. Sighting areas at Lassen and Crater Lake also may be at an elevated risk into the future because the subspecies is already using most of the highest elevation habitats available. In considering these factors, the Species Report ascribed a medium-level impact to Sierra Nevada red fox for this stressor (Service 2005a, pp. 47–48). Modeling projections are done at a large scale, and effects to species' habitat can be complex, unpredictable, and highly influenced by local-level biotic and abiotic factors. Although many climate models generally agree about potential future changes in temperature and a greater proportion of precipitation falling as rain rather than snow, the consequent effects on snowpack levels and possibly vegetation changes are more uncertain, as is the rate at which any such changes might be realized. Therefore, it is not clear how or when changes in snowpack levels, forest type, or plant species composition will affect the distribution of Sierra Nevada red fox habitat. Thus, uncertainty exists when determining the level of impact climate change may have on Sierra Nevada red fox habitat. Consequently, at this time and based on the analysis contained within the Species Report and summarized above, we have determined that we do not have reliable information to indicate that climate change is a

threat to Sierra Nevada red fox habitat now or in the future, although we will continue to seek additional information concerning how climate change may affect the subspecies' habitat.

Trapping or Hunting

Trapping for Fur

The Sierra Nevada red fox has historically been hunted and trapped for its thickly furred pelt, which was the most valuable of any terrestrial animal in California (Grinnell *et al.* 1937, pp. 396–397). The average yearly harvest in California was approximately 21 animals in the 1920s (Grinnell *et al.* 1937, p. 389); by the 1940s and 1950s (over the 20-year period), the average yearly harvest in California had decreased to 6.75 animals (Perrine 2005, p. 154). Legal Sierra Nevada red fox fur trapping in California ended in 1974 (CDFG 1987, p. 4; Perrine 2005, p. 2). Until recently, Sierra Nevada red fox in Oregon were considered to be Cascade foxes—of the same subspecies that occupied the Cascades in Washington (Sacks *et al.* 2010a, p. 1536). Fur trapping is regulated and remains legal throughout Oregon (*Factor B*), although information is not available regarding historical hunting and trapping pressures on foxes in the Oregon Cascades.

Due to regulatory protections, hunting and trapping do not constitute a current or likely future stressor to Sierra Nevada populations in California or at the Crater Lake sighting area in Oregon, as there is no legal hunting or fur trapping for Sierra Nevada red fox in California or at Crater Lake National Park where the sightings in that area are known. In the counties where the other four Oregon sighting areas occur, low numbers of red foxes are harvested, some of which may be Sierra Nevada red fox. Fox harvest rates in Oregon have generally been low, however, and have been declining in recent years. Hunting and trapping potentially impact individual Sierra Nevada red fox within the four Oregon sighting areas (excluding Crater Lake). However, in the absence of more definite information regarding population levels of the subspecies in Oregon, we do not consider such harvest levels likely to produce detrimental impacts to Sierra Nevada red fox populations, as a whole, across its range. These activities therefore constitute stressors meeting the definition of low-level impact. The best available data indicate that relatively few red fox (some of which may be Sierra Nevada red fox) are removed from an unknown number of populations as a result of fur trapping in Oregon, and

we have no evidence to suggest that the subspecies is in decline as a consequence of fur trapping.

Based on the analysis contained within the Species Report and summarized above, we consider the legal fur trapping of Sierra Nevada red fox as having no overall impact to Sierra Nevada red fox at the Sonora Pass, Lassen, and Crater Lake sighting areas, as there is no legal fur trapping for Sierra Nevada red fox in California and at Crater Lake National Park. Fur trapping harvest for red fox in the four remaining Oregon sighting areas is relatively minimal, and red fox harvested are likely not trapped or minimally trapped in the high elevations where the Sierra Nevada red fox resides. Thus, we estimate at most a low level of impact to the four northernmost sighting areas in Oregon. We estimate that the potential impacts of fur trapping on Sierra Nevada red fox in Oregon (outside of the Crater Lake sighting area) will continue at a similar level, both currently and into the future, because the best available data do not suggest that either fur trapping effort or impacts are likely to change. Additionally, of note for California, we expect that nearly all Sierra Nevada red fox that are accidentally captured in box traps (body-gripping traps are illegal in California) set for other furbearer species, or that are live-trapped for research purposes, will be released unharmed. As a result of this best available information for Oregon and California, we have determined that fur trapping, overall, does not have a significant population-level impact across the subspecies' range and therefore does not rise to the level of a threat currently nor is it likely to increase into the future.

Trapping for Research Purposes

We consider the potential impacts of live-trapping and handling for research purposes (*Factor B*) on Sierra Nevada red fox as discountable. There is limited distribution of Sierra Nevada red fox research projects across the subspecies' range (*e.g.*, noninvasive sampling (hair and scat collection), camera-trapping, or both, at Sonora Pass, Lassen, Mount Hood; and in other Oregon sighting areas as funding permits). The best available data indicate that no Sierra Nevada red fox have been injured or killed as a result of research-related live-trapping or handling efforts. Available information does not suggest that there would be any change to the level of anticipated impacts of live-trapping and handling for research purposes into the future, and, therefore, we find that the potential impacts to the Sierra Nevada

red fox from trapping for research purposes do not rise to the level of a threat.

Disease

Numerous pathogens are known to cause severe disease (*Factor C*) in canids. Those that have the highest potential to have population-level impacts on Sierra Nevada red fox are sarcoptic mange, canine distemper, and rabies (Perrine 2010, pp. 17, 28), as well as SPD and EFF. Although the CDFW (2015, p. 2) has noted cases of rabies and distemper in gray foxes (*Urocyon cinereoargenteus*) in Lassen County, the best available data do not indicate impacts to Sierra Nevada red fox from these three diseases in any of the seven sighting areas. Future impacts of such diseases on any given population are difficult to predict, but the low population densities of the subspecies (Perrine *et al.* 2010, p. 9) should make transmission within a population or sighting area less likely except within family groups. The relative isolation of the sighting areas themselves should make transmission from one such area to another less likely, particularly for the Lassen, Sonora Pass, Crater Lake, and Mt. Hood sighting areas because they are the most physically separated from the sighting areas nearest to them.

SPD and EFF are known to occur within the subspecies' range and could potentially result in bacterial infections that are typically fatal to canids. Foxes are highly susceptible to SPD, as are domestic dogs and coyotes (Cordy and Gorham 1950, p. 622; Headley *et al.* 2009, p. 1). The responsible bacterium, *Neorickettsia helminthoeca*, is transmitted to canines when they eat infected fish (generally, but not solely, salmonids—trout or salmon), or infected Pacific giant salamanders (*Dicamptodon* spp.) (Headley *et al.* 2009, pp. 3, 4; Rikihsa 2014, p. 2). The range of the SPD (and thus presumably of the host snail) extends north from California (north of the Sonora Pass sighting area, but including the Lassen sighting area) through western Oregon (including the western slopes of the Cascades) to the Olympic Peninsula of Washington State (Headley *et al.* 2009, p. 2). Naturally occurring cases of SPD infection have been found in red foxes in the past (Todoroff and Brown, p. 5), though never in Sierra Nevada red fox. Additional future opportunities for ingestion of infected fish may occur in the Lassen sighting area, as improvements to Pine Creek allow infected Eagle Lake trout to spawn in headwaters of the creek within the Lassen sighting area. EFF is widely present in Oregon and is transmitted in

the same manner as SPD (with the same flatworm vector and snail host) (Rikihsa 2014, pp. 1–3).

The presence of SPD and EFF within the range of the Sierra Nevada red fox is considered minimal, with no exposures detected within the subspecies. As stated above, SPD is native in western Oregon, from the coast to the western slopes of the Cascades (Headley *et al.* 2009, p. 2), and EFF is endemic throughout Oregon. Thus, all five Oregon sighting areas are subject to exposure. We also consider the likelihood of exposure of SPD and EFF in the Oregon Cascades to have remained constant (but low) in recent years, and expect that it will continue at the same level into the future. The Lassen sighting area is outside the historical range of SPD (Todoroff and Brown 2014, p. 6), and we have no information regarding presence of EFF at that location. However, rainbow trout from various hatcheries are stocked in the Lassen National Forest for recreational fishing (Todoroff and Brown 2014, p. 15). The Sonora Pass sighting area is unlikely to be exposed because CDFW does not stock fish from northern California south of the Feather River in order to prevent transmittal of diseases (including SPD and EFF) (Beale 2011, p. 1).

Overall, despite possible exposure to pathogens, no outbreaks of sarcoptic mange, canine distemper, rabies, SPD, or EFF have been detected in Sierra Nevada red fox, and we have no evidence to suggest that disease has impacted Sierra Nevada red fox in the past, nor do we have evidence to suggest that any diseases are present currently or will be present in the future in any of the Sierra Nevada red fox sighting areas. Additionally, given the current sighting areas are disjunct from one another, this would be beneficial in terms of reducing the ease of transmission of disease between the sighting areas, should an outbreak occur. Thus, as presented in the Species Report and summarized here, the best available scientific and commercial data do not indicate that a disease outbreak has had, or is likely to have, a significant population-level effect on Sierra Nevada red fox. We note that there is a low probability that a disease outbreak may occur. We anticipate that if there should be an outbreak, it will likely have a low effect on all seven sighting areas combined, as the distance between them makes it unlikely that the effects of such an outbreak would spread. Thus, we have determined that disease has a low-level population impact across the range of the Sierra Nevada red fox and, therefore, does not

rise to the level of a threat currently nor is it likely to increase into the future.

Predation by Domestic Dogs or Coyotes

Sierra Nevada red fox could be predated on by domestic dogs at recreational areas (such as ski lodges or national parks) within their sighting areas, and in the course of being hunted with dogs, in any of the Oregon sighting areas other than at Crater Lake (*Factor C*). Dogs are more likely to interact with Sierra Nevada red fox at the Crater Lake and Willamette Pass sighting areas (but they also could potentially be found along many other roads or recreational areas (*e.g.*, hiking trails) within the subspecies' range), where they are allowed on roads, parking lots, campgrounds, and picnic areas. To date, one documented case of Sierra Nevada red fox predation by a dog exists (*i.e.*, a radio-collared female Sierra Nevada red fox was found dead in October 2002, as a result of a dog attack within 175 m (574 ft) of a ski chalet in the Lassen sighting area (Perrine 2005, p. 141)). Overall, the best available information indicates that predation by dogs is not producing population-level or subspecies-level effects to Sierra Nevada red fox currently, nor is this stressor expected to increase in the future. Therefore, predation by dogs is considered a low-level impact that may potentially impact individuals across the subspecies' range (although more likely in two of the seven sighting areas) and, therefore, does not rise to the level of a threat to the subspecies currently nor is it likely to increase into the future.

Sierra Nevada red fox could also be predated by coyotes (*Factor C*). Sierra Nevada red fox and coyotes both are opportunistic predators with considerable overlap in food consumed (Perrine 2005, pp. 36–37). Although no direct documentation of coyote predation on Sierra Nevada red fox is available, coyotes will chase and occasionally kill other North American red fox subspecies, and are considered important competitors of red fox generally (Perrine 2005, pp. 36, 55; Perrine *et al.* 2010, p. 17). Thus, red foxes tend to avoid areas frequented by coyotes (though not necessarily to the point of complete exclusion) (Perrine 2005, p. 55). Additional discussion specifically related to coyote competition with Sierra Nevada red fox is presented in *Competition With Coyotes*, above.

The general tendency of red foxes to avoid coyotes often relegates them to suboptimal habitats and has likely been an important factor determining red fox distribution (Perrine 2010, p. 20; Sacks

et al. 2010b, p. 17). Perrine (2005, pp. 84, 105) suggests that predation (and competition; see *Competition With Coyotes*, above) from coyotes is likely a primary reason why the range of Sierra Nevada red fox is restricted to such high elevations.

Minimal information exists on Sierra Nevada red fox and coyote interactions with relation to the potential for predation. Perrine's (2005, pp. 73–74) investigations at the Lassen sighting area during summer months found coyotes present at all elevations with a positive correlation between Sierra Nevada red fox and coyotes during that time (which was a likely artifact of their common affinity for roads (Perrine 2005, p. 83)). However, Perrine (2005, p. 192) found coyote population density to be greater at lower elevations, thus producing an elevational separation between most coyotes and the Sierra Nevada red fox population. During winter months in the Lassen sighting area, Perrine (2005, pp. 30, 78) found that both Sierra Nevada red fox and coyotes descended to lower elevations, where mule deer (*Odocoileus hemionus*) (and more specifically in the case of Sierra Nevada red fox, mule deer carrion) became important components of their diets. Perrine (2005, p. 31) also notes that Sierra Nevada red fox may potentially benefit from the presence of coyotes during winter by scavenging deer carcasses killed by coyotes. However, Sierra Nevada red fox, whose main winter food source (at the Lassen study site) was small rodents rather than deer (Perrine 2005, p. 24), tend to stay at higher elevations than coyotes, thereby reducing potential predation.

At this time, the best available data indicate that coyotes are present year-round throughout the subspecies' range, but generally at lower elevations than Sierra Nevada red fox during winter and early spring when snowpacks are high (Service 2015, p. 52). Regardless, information does not indicate there has been any coyote predation on Sierra Nevada red fox, nor is there any information to indicate that coyotes are increasing at any of the sighting areas. However, as climate change progresses, climatologists predict that snowpacks are expected to diminish in the future (Kapnick and Hall 2010, pp. 3446, 3448; Halofsky *et al.* 2011, p. 21). Thus, higher elevations with deep snowpack that currently deter coyotes may become more favorable to them, potentially increasing the likelihood of coyote predation in the future. For instance, in the Sonora Pass sighting area, unusually low snowpacks occurred in 2013 (Rich 2014, pers. comm., p. 1), which allowed a family of four coyotes to establish a

year-round territory in the high-elevation portions of the range (Quinn and Sacks 2014, p. 12). Sierra Nevada red fox are likely to be most vulnerable to predation and competition from coyotes during early spring because Sierra Nevada red fox typically establish territories and begin raising pups around that time. In some sighting areas, the subspecies may be able to respond to reduction of snowpacks and encroachment of coyotes by retreating to higher elevations to raise pups. But in the Crater Lake, Lassen, and Sonora Pass sighting areas, Sierra Nevada red fox already occupy the highest available elevations.

Recently, two packs of gray wolves have become established in the Southern Cascades between the Crater Lake and Lassen sighting areas (one pack each in Oregon and California). It is probable that restoration of wolves to the Southern Cascades in sustainable populations would lower coyote population numbers or exclude them from higher elevation forested areas, thereby facilitating the persistence of nearby Sierra Nevada red fox populations (Levi and Wilmers 2012, p. 926); wolves are unlikely to compete heavily with Sierra Nevada red fox because they tend to take larger game (ODFW 2015, p. 8). At this time in Oregon, ODFW's conservation objectives for the wolf include establishment of seven breeding pairs in western Oregon for 3 consecutive years (ODFW 2010, p. 17). In California, the wolf pack discovery is so new that CDFW and the Service have just initiated coordination efforts, and we anticipate additional conservation-related coordination efforts in the near future. Accordingly, we consider it likely that the current wolf population will expand over the next 50 years to effectively overlap the Crater Lake sighting area, and possibly the Willamette Pass, Dutchman Flat, and Mt. Washington sighting areas (ODFW 2015, pp. 3, 4). Therefore, we currently lack information that coyote predation on Sierra Nevada red fox is likely to occur over the next 50 years at the Crater Lake sighting area, or at the three more-northerly Oregon sighting areas.

Based on the best available scientific and commercial data, we find that predation may have had an overall low-level impact to the Sierra Nevada red fox due to the presence of coyotes co-occurring at multiple sighting areas within the subspecies' range; the potential for predation in the Crater Lake, Lassen, and Sonora Pass sighting areas into the future given climate model projections of decreased snowpack levels that may make the

habitat more favorable to coyotes; and the overall inability of the populations at those three locations to shift up in elevation (*i.e.*, the Crater Lake, Lassen, and Sonora Pass populations appear at or near the highest elevations available for the subspecies). However, at this time, the best available data indicate that predation is not impacting the Sierra Nevada red fox at the subspecies-level to the degree that any more than individuals at a couple of the sighting areas may be affected both currently and into the future. Further, the best available data do not indicate that potential future changes in shifting habitat at high elevations (as suggested by climate models) would occur within the next 50 years to such a degree that coyote numbers would increase significantly throughout the subspecies' range to the point that coyote predation would rise to the level of a threat. Therefore, based on the analysis contained within the Species Report and summarized above, we have determined that predation does not rise to the level of a threat currently nor is it likely to increase into the future.

Hybridization With Nonnative Red Fox

Hybridization of Sierra Nevada red fox with other nonnative red fox (*Factor E*) could result in outbreeding depression or genetic swamping (Quinn and Sacks 2014, pp. 16–17). Outbreeding depression is a reduction in survivorship or reproduction caused by an influx into the population of alleles from other areas. Such a reduction can be caused by the loss of locally adaptive alleles, or by the breakup of co-adapted gene complexes (*i.e.*, groups of alleles that work together to provide a particular ability or advantage in the native habitat) (Templeton 1986, pp. 106–107; Quinn and Sacks 2014, p. 17). Genetic swamping occurs when continued influx of outside alleles cause the replacement of most native alleles, effectively turning what was once a native population into a population of some other subspecies or species.

The best available data indicate that hybridization with nonnative red fox has been documented within the Sierra Nevada red fox's range at two sighting areas. First, hybridization with nonnative red fox is occurring at the Sonora Pass sighting area (Quinn and Sacks 2014, pp. 2, 10). Researchers documented interbreeding between female Sierra Nevada red fox and two male nonnative red foxes, resulting in seven hybrid pups in 2013, and an additional four hybrid pups in 2014 (Sacks *et al.* 2015, p. 3). These hybrids were the only clear indication of

successful reproduction in the study area between 2011 and 2014. In comparison, only eight full-blooded Sierra Nevada red fox were identified in the area during those years (Sacks *et al.* 2015, p. 3). Second, two Sierra Nevada red fox individuals at the Mt. Hood sighting area show evidence (via genetic testing of mtDNA) of past hybridization with nonnative red foxes, although the timing and extent of that hybridization remains unknown (Akins and Sacks 2015, p. 1).

Based on the information presented above and in the Species Report (Service 2015, pp. 42–43), the best available data indicate that nonnative red fox are currently present in one sighting area (*i.e.*, the Sonora Pass sighting area) and historically known from the Mt. Hood sighting area but not known to be present currently. These are the only sighting areas within the subspecies' range where hybridization has been documented to date, although it is possible that nonnative red fox could occur in other portions of the subspecies' range. At this time, based on the best available scientific and commercial information, this stressor does not rise to the level of a threat to the subspecies because information indicates hybridization is currently occurring within portions of only one sighting area across the subspecies' range, with only a single record of past hybridization occurring at the Mt. Hood sighting area, and we have no information to indicate this level of impact will increase into the future.

Vehicles

Collision with vehicles (*Factor E*) is a known source of mortality for the Sierra Nevada red fox currently and is expected to continue into the future, given the presence of roads within the range of the subspecies. A low density of roads with heavy traffic traveling at high speeds (greater than 45 miles per hour) suggest that few individuals die from vehicle collisions. There are a total of three reports since 2010 of road-killed Sierra Nevada red foxes across the subspecies' range, one each occurring at the Sonora Pass sighting area (California State Highway 395), the Crater Lake sighting area (main Park road near administration building), and near Silver Lake, Oregon, about 80 km (50 mi) west of the Crater Lake sighting area (Statham *et al.* 2012, p. 124; Mohren 2015, p. 1; Doerr 2015, p. 14).

Snowmobiles are another potential source for collisions and noise disturbance (*Factor E*) in all sighting areas with the exception potentially of the Lassen sighting area and a small area in the northwest portion of the Crater

Lake sighting area, given the high level of recreational activity within or adjacent to those sighting areas. However, no snowmobile-related incidents have been reported. Researchers are currently investigating potential impacts of snowmobile activity to Sierra Nevada red fox in the Sonora Pass sighting area in accordance with Standard 32 from the SNFPA, which requires activities near verified Sierra Nevada red fox sightings to be analyzed to determine if they have a potential to affect the subspecies (USDA 2004, p. 54; Rich 2014, p. 1). Results are not yet available, in part because the snowpack has been low during the last two winters (those ending in 2013 and 2014), and, therefore, the area has not been available for snowmobile use (Rich 2014, p. 1). Additionally, although no studies have been completed, the mere location of the Sierra Nevada red fox sightings in these areas suggest that the subspecies adjusts to the noise involved, and that sufficient Sierra Nevada red fox prey remain in such areas.

Overall across the Sierra Nevada red fox's range, few Sierra Nevada red fox are killed as the result of collisions with vehicles. We expect that in the future a small number of individuals will be struck by vehicles, including dispersing juveniles searching for unoccupied suitable habitat for establishment of a home range. However, the best available information does not suggest any significant increases in vehicular traffic or new roads are likely in areas where the subspecies occurs. Therefore, based on the information presented above and in the Species Report (Service 2015, pp. 53–55), the best available data indicate that the impact of vehicle collisions on Sierra Nevada red fox will be minor and continue at similar levels into the future, resulting in a low-level impact on the subspecies (*i.e.*, impacts to individual Sierra Nevada red foxes as opposed to populations); therefore, this stressor does not rise to the level of a threat.

Small and Isolated Population Effects

Small, isolated populations (*Factor E*) are more susceptible to impacts overall, and relatively more vulnerable to extinction due to genetic problems, demographic and environmental fluctuations, and natural catastrophes (Primack 1993, p. 255). That is, the smaller a population becomes, the more likely it is that one or more stressors could impact a population, potentially reducing its size such that it is at increased risk of extinction. Particularly small populations may suffer reproductive decreases due to demographic stochasticity: A sex ratio

heavily skewed by chance from 50:50 (Soule and Simberloff 1986, p. 28). Inbreeding depression may result from the accumulation of deleterious alleles (gene variants) in the population (Soule 1980, pp. 157–158). This happens because alleles in general tend to be lost quickly from small populations due to the chance nature of reproduction (genetic drift) (Soule 1980, pp. 157–158). Additionally, inbreeding effects may occur because closely related individuals are likely to share many of the same deleterious alleles, and are thus more likely to pass two copies of a deleterious allele to their young, even if non-deleterious versions of the gene still remain in the population (Soule 1980, pp. 157–158). Over time, inbreeding depression also commonly results in low reproductive success (Soule 1980, pp. 157–158; O'Brien 2003, pp. 62–63; Quinn and Sacks 2014, p. 15). Given the best available information on Sierra Nevada red fox at this time, we evaluated information suggesting that Sierra Nevada red fox populations may be small or isolated from one another to the degree that such negative effects may be realized in the subspecies.

It is probable that Sierra Nevada red fox population densities have always been relatively low, although historical populations likely have not been as isolated as they appear to be today, particularly in California. Based on interviews with trappers, Grinnell *et al.* (1937, p. 396) described Sierra Nevada red fox population numbers as “relatively small, even in the most favorable territory,” and reported that the subspecies likely occurred at densities of 1 per 2.6 square km (1 per square mi). Perrine *et al.* (2010, p. 9) concluded from this that Sierra Nevada red fox likely occur at low population densities even within areas of high relative abundance. Additionally, although data are not available across the historical range of the subspecies, the best available information suggests that Sierra Nevada red fox distribution within California (*i.e.*, Lassen and Sonora Pass sighting areas) has contracted in the recent past. For example, Schempf and White (1977, p. 44) examined CDFW sighting and trapping data and found that in California, the number of sightings and trappings fell considerably in the mid-1900s as compared to similar data reported by Grinnell *et al.* (1937, p. 389).

At present, we have identified at least seven sighting areas: (1) Five in the Oregon Cascades from Mt. Hood south to the Crater Lake vicinity; (2) one in the southern extent of the Cascades in

California (Lassen sighting area); and (3) one in the Sierra Nevada mountain range (Sonora Pass sighting area) (see Figure 1, above). This represents a significant increase in our knowledge of the subspecies' distribution as compared to that known at the time of the 90-day finding (77 FR 45; January 3, 2012), which at that time included only the Lassen and Sonora Pass sighting areas. Surveys and incidental sightings conducted in 2012 and 2013 include 35 from near Mt. Hood, 13 from around Mt. Washington, 2 from near Dutchman Flat, 8 from around Willamette Pass, and 43 from the area of Crater Lake National Park (Sacks 2014b, pp. 3–5; Cascadia Wild 2014, p. 1). As a result of the newly identified area of the historical range in the Oregon Cascades, researchers have not yet determined the exact number of individuals or populations that currently exist in Oregon, nor the distribution of those populations. It is likely the number of individuals actually sighted is less than the number of actual individuals present in these sighting areas because the same individual may be sighted numerous times (Perrine 2005, pp. 147, 148). Surveys are continuing at the time of publication of this document.

In most cases of small populations, genetic interchange need occur only occasionally between populations (a minimum of 1 migrant per generation, possibly up to 10 migrants per generation) to offset the potential negative impacts of inbreeding (*e.g.*, Mills and Allendorf 1996, p. 1516; Wang 2004, entire). In addition, depending on population sizes and the distance between them, the ability of even a few individuals to move between population areas can preserve the potential for recolonization or augmentation (Brown and Kodric-Brown 1977, entire).

For the Sierra Nevada red fox in the Southern Cascades range, suitable habitat that could harbor additional individuals or provide for dispersal occurs between the Oregon sighting areas, as well as between the southernmost Oregon sighting area (Crater Lake) and the northernmost California sighting area (Lassen). Although the Sierra Nevada red fox's dispersal distance is not known, Statham *et al.* (2012, p. 130) state that juvenile male red foxes in the American Midwest dispersed an average of 30 km (18.6 mi); juvenile females dispersed an average of 10 km (6.2 mi); and a few young red foxes (5 percent) dispersed over 80 km (50 mi) in their first year. Distances between the Southern Cascades range sighting areas (north to south) are 90 km (56 mi), 25 km (15.5

mi), 45 km (28 mi), 50 km (31 mi), and 250 km (155 mi), respectively, and there are no clear barriers to dispersal, particularly within Oregon. Although these data are based on dispersal information for a different geographic location and habitat type, it is the best available dispersal information for red fox, indicating that dispersal of Sierra Nevada red fox could be rare but possible between the majority of sighting areas in the Southern Cascades range. Based on our evaluation of the best available information, the Sonora Pass sighting area (and population) within the Sierra Nevada portion of the subspecies' range appears isolated, given that it is 150 km (93 mi) from the Lassen population to the north, with no known Sierra Nevada red fox sightings or populations to the south. At this time, the combined small size and apparent isolation of the Sonora Pass population make future impacts from inbreeding depression and from stochastic events possible.

As stated above, information is not available on population size and various life-history characteristics specific to the Sierra Nevada red fox within the Oregon Cascades portion of the subspecies' range. The majority of information available on population size and life history of the subspecies is from the two California sighting areas, both of which have been identified as two separate populations that are not interbreeding (based on genetic information (Statham *et al.* 2012, pp. 129–130)). Population size for these known populations include: (1) Lassen—42 adults, or 21 breeding and 21 nonbreeding individuals; and (2) Sonora Pass—29 adults, or 14 breeding and 15 nonbreeding individuals (see Table 1, above, for additional details).

As stated above, survey efforts are underway throughout the Oregon Cascades, having been limited to California prior to June 2010 (when the Service learned that the Oregon Cascades range was newly considered to be a part of the subspecies' historical range). In the Sierra Nevada portion of the subspecies' range, the majority of information has been provided from various carnivore and fox surveys between 1996 and 2014 (Perrine 2005; Mohren 2014; Sacks 2014b; Ferland 2014; Akins 2014; Doerr 2015, pp. 1–14). These surveys have been extensive throughout large portions of this portion of the range to such a degree that we do not anticipate other populations of Sierra Nevada red fox currently within the Sierra Nevada. Given the above information, we consider the Sonora Pass sighting area (population) to currently be isolated and small although

it appears that considerable suitable habitat occurs at the appropriate elevation throughout portions of the subspecies historical range in the Sierra Nevada.

Based upon the analysis contained within the Species Report and summarized above, we determined that impacts associated with small population size is an overall moderate-level impact, specifically as it relates to the Lassen and Sonora Pass sighting areas, which may be small and isolated enough to be at risk of impacts from inbreeding depression and chance deleterious events. The primary risk of such impacts is in the future (within 50 years), although evidence of low reproductive success based on studies in portions of both populations (see Population/Abundance Information, above) suggest this could constitute a current impact of inbreeding depression, but to an unknown degree. Overall across the subspecies range at this time, the best available information indicates that Sierra Nevada red foxes may be reduced in distribution relative to their historical range (and possibly reduced in numbers relative to abundance); however, there is no empirical evidence that the Sierra Nevada red fox is in decline across its range. Thus, small or isolated population size effects do not rise to the level of a threat either currently or in the future.

Cumulative Effects

We estimate the potential impact of each stressor described above acting alone on Sierra Nevada red fox individuals, populations, and suitable habitat. However, Sierra Nevada red fox and suitable habitat can also be affected by all or some of the stressors acting together. The combined effects of those stressors could impact the subspecies or suitable habitat in an additive or synergistic manner. Acting together, one or more stressors could impact individuals, a portion of a sighting area or population, or available suitable habitat to varying degrees or magnitude, whereas alone a single stressor may not significantly impact the subspecies or its habitat.

Based on our analysis of all stressors that may be impacting Sierra Nevada red fox or their habitat, if any cumulative impacts occur, they would do so under the following two scenarios:

(1) Potential increased competition with coyotes on Sierra Nevada red fox as a result of high-elevation forested areas becoming more suitable for coyotes following potential impacts from climate change (*i.e.*, lowered

snowpack levels, increased incidence and extent of wildfires).

(2) A combination of potential stressors (*i.e.*, hunting and trapping, SPD and other diseases, competition and predation from coyotes, hybridization with nonnative red fox, and vehicles) that directly result in death or loss of reproductive ability for the Sierra Nevada red fox.

Here we consider the impacts of each of these potential cumulative effect scenarios:

Models of climate change predict potential increases in temperature within the Sierra Nevada red fox's range of the southern Cascades and Sierra Nevada ranges. In turn, this could result in lower snowpack levels and an increase in the number and extent of wildfires, leading to increased competition and predation from coyotes that currently (and primarily) reside at lower elevations in habitat that is more favorable to them. As described in our analyses discussing coyote predation (see *Predation by Domestic Dogs or Coyotes*, above) and competition (see *Competition With Coyotes*, above), we expect that impacts associated with coyotes may continue to occur in most sighting areas throughout the range of the Sierra Nevada red fox into the future, and that lowered snowpack levels or wildfire impacts that may result in a shift in Sierra Nevada red fox distribution (where possible) is not likely over the next 50 years. Thus, we expect similar levels of competition and predation as what may be occurring currently throughout the subspecies range, or possibly lowered levels as a result of the recent establishment of gray wolves in the southern portion of the Oregon Cascades. Therefore, the best available data at this time do not suggest that the cumulative effects of increased coyote numbers and climate change rise to the level of a threat to the Sierra Nevada red fox overall.

When a population is small, the relative importance to the population of each potentially reproducing individual is increased. Thus, potential stressors that directly result in death or loss of reproductive ability for individual Sierra Nevada red fox where their populations are known to be small could have a greater relative impact on small populations than on larger ones. As indicated above, the stressors that could potentially impact the reproductive ability of the Sierra Nevada red fox include hunting and trapping, SPD and other diseases, competition and predation from coyotes, hybridization with nonnative red fox, and collision with vehicles. The

best available data at this time indicate that:

(1) Potential impacts associated with hunting and trapping (*Factor B*), SPD and other diseases (*Factor C*), and vehicles (*Factor E*) are negligible or nonexistent, and there is no indication that these stressors are expected to change into the future to such a degree that they would significantly contribute to decreased reproductive viability of the Sierra Nevada red fox either by themselves or cumulatively.

(2) As discussed above under *Predation by Domestic Dogs or Coyotes*, *Competition With Coyotes*, and *Hybridization With Nonnative Red Fox* sections, coyotes and nonnative red fox are currently known to occur in multiple areas within the Sierra Nevada red fox's range. Coyote abundance at high-elevation areas could increase in the future if decreased snowpack levels at high elevations occur, potentially resulting in more favorable habitat conditions for them. It is possible that nonnative red fox could also increase in numbers in the future, or result in impacts greater than what has currently been observed. However, based on climate models and possible resultant changes in vegetation types, such increases in abundance of either of these are not likely in the next 50 years. Therefore, we do not believe increases in nonnative red foxes or coyotes will contribute to cumulative effects to the Sierra Nevada red fox. Information to support this includes:

(a) The continued presence and spread of wolves across the west, it is reasonable to assume the two wolf packs now established in the Southern Cascades (*i.e.*, between the Crater Lake and Lassen sighting areas) will remain and increase in pack size given ongoing conservation, thus further decreasing the likelihood and magnitude of coyote-related impacts (due to expected competition between wolves and coyotes (see *Competition With Coyotes*, above)) within this portion of the subspecies' range into the future.

(b) The majority of the Sierra Nevada red fox's range harbors high-elevation area above elevations considered suitable for coyotes. Thus, Sierra Nevada red fox could utilize this additional area if snowpack levels decrease from their current extent. The least amount of additional high-elevation area available for Sierra Nevada red fox to shift upwards is at the Lassen and Sonora Pass sighting areas, and no shift up in elevation appears available at the Crater Lake sighting area. However, the latter is also the closest sighting area to benefit from decreased potential coyote competition/

predation associated with the recently established wolf pack (approximately 24 km (15 mi) south of the Crater Lake sighting area).

(c) Some unknown level of nonnative red fox hybridization may continue into the future within portions of the Sierra Nevada red fox's range. However, the best available data do not indicate that hybridization would increase to a significant degree throughout the Sierra Nevada red fox's range within the next 50 years such that the extent and magnitude of impacts would be significant contributors to the overall potential cumulative impacts to the subspecies across its range. At this time, hybridization is of concern specifically at the Sonora Pass sighting area as opposed to across the entire range of the subspecies (given the Sonora Pass sighting area's apparent small and isolated population size and recent lack of reproduction with its own subspecies).

In summary, the best available scientific and commercial data at this time do not show that combined effects of the most likely cumulative impact scenarios are resulting in significant individual-level effects to the Sierra Nevada red fox, or population-level effects across multiple populations/sighting areas. Although all or some of the stressors could potentially act in concert as a cumulative threat to the Sierra Nevada red fox, there is ambiguity in either the likelihood or level of impacts for the various stressors at the population or rangewide level, or the data indicate only individual-level impacts. It is probable that Sierra Nevada red fox populations today are smaller than historical times, which potentially increases the vulnerability of the subspecies to potential cumulative low- or medium-level impacts. Although the Lassen and Sonora Pass populations experienced a bottleneck or decline in the recent past (Sacks *et al.* 2010a, pp. 1523, 1536), the best available information does not provide reliable evidence to suggest that Sierra Nevada red fox sighting areas (or known populations specifically at the Lassen and Sonora Pass sighting areas) are currently experiencing population declines or further reductions in distribution, which would be indicative of such impacts. Thus, the best available scientific and commercial data do not indicate that these stressors are cumulatively causing now or will cause in the future a substantial decline of the Sierra Nevada red fox across its range. Therefore, we have determined that the cumulative impacts of these potential stressors do not rise to the level of a threat.

Existing Regulatory Mechanisms

Existing regulatory mechanisms that affect the Sierra Nevada red fox include laws and regulations promulgated by the Federal and individual State governments (*Factor D*). Federal agencies manage nearly all of the lands represented by the currently known sighting areas, with the exception of a few private inholdings in the Lassen sighting area. No tribal governments (sovereign entities with their own system of laws and regulations) own or manage lands within potentially suitable habitat within the range of the subspecies. Stressors acting on the Sierra Nevada red fox for which governments may have regulatory control include impacts associated with wildfire and fire suppression (*Factor A*—habitat modification or loss), injury or mortality due to fur trapping (*Factor B*), and collision with vehicles (*Factor E*). These regulations differ among government entities, are explained in detail in the Species Report (Service 2015, pp. 58–63), and are summarized below.

Federal

Forest Service

The Forest Service policy manual (USDA FS 2005, section 2670.22) allows for designation of sensitive species of management concern. The Sierra Nevada red fox is a sensitive species where it occurs on National Forests in California (U.S. Forest Service Region 5) and in Oregon (U.S. Forest Service Region 6) (USDA 2013, p. 1; Chapman 2015, Excel atch., wksht. 2, line 655). The Sensitive Species Policy is contained in the Forest Service Manual, section 2670.32 (USDA Forest Service 2005, section 2670.32) and calls for National Forests to assist and coordinate with other Federal agencies and States to conserve these species. Special consideration for sensitive species is made during land use planning and activity implementation to ensure species viability and to preclude population declines that could lead to a Federal listing under the Act (USDA Forest Service 2005, section 2670.22). At this time, proposed activities that occur within National Forests within the range of the Sierra Nevada red fox will include measures to avoid or minimize project-related impacts to the subspecies and its habitat.

National Forest management is directed by the Multiple-Use Sustained-Yield Act of 1960, as amended (16 U.S.C. 528 *et seq.*) and the National Forest Management Act of 1976, as amended (NFMA) (16 U.S.C. 1600 *et seq.*). NFMA specifies that the Forest

Service must have an LRMP to guide and set standards for all natural resource management activities on each National Forest or National Grassland. Current LRMPs within the range of the Sierra Nevada red fox were developed under the 1982 planning rule (47 FR 43026; September 30, 1982, pp. 43037–43052), which required the Forest Service to maintain viable populations of existing native and desired nonnative vertebrate species. Recently revised NFMA planning rules (77 FR 21162, April 9, 2012) require National Forests to use an ecosystem and species-specific approach in their LRMPs to provide for the diversity of plant and animal communities and maintain the persistence of native species in the plan areas. As stated above, the Sierra Nevada red fox is a sensitive species of conservation concern under these new rules in all the National Forests in which it occurs.

The NWFP (USDA and U.S. Department of the Interior (USDI) 1994, entire) was adopted by the Forest Service in 1994, to guide the management of over 9.7 million ha (24 million ac) of Federal lands (USDA and USDI 1994, p. 2) in portions of western Washington and Oregon, and northwestern California within the range of the northern spotted owl (*Strix occidentalis caurina*). The NWFP amends the LRMPs of National Forests (*i.e.*, the Mt. Hood, Willamette, Deschutes, Umpqua, Winema, and Rogue River National Forest's LRMPs) and is intended to provide the basis for conservation of the spotted owl and other late-successional, old-growth forest associated species on Federal lands. The NWFP is important for the Sierra Nevada red fox because the conservation initially established to benefit the northern spotted owl also creates a network of late-successional and old-growth forests that help meet the Sierra Nevada red fox's habitat requirements (see *Summary of Species Information*, above, and the "Habitat" section of the Species Report (Service 2015, pp. 14–16)) at four of five Oregon sighting areas (*i.e.*, Mt. Hood, Mt. Washington, Dutchman Flat, and Willamette Pass Sighting areas). Additionally, the NWFP establishes reserve lands (consisting of Congressionally Reserved Areas such as Wilderness Areas, Late Successional Reserves, Administratively Withdrawn areas, and any additional reserved areas identified by the LRMP for the National Forest in question) that are managed to protect and enhance conditions of late-successional and old-growth forest ecosystems (USDA and USDI 1994, C8–

C11; USDA 2015, p. 4), all of which includes habitat managed over the long term that will likely continue to benefit the Sierra Nevada red fox.

Forest Service lands outside of the NWFP areas (a portion of lands within the Lassen and Sonora Pass Sighting areas) operate under LRMPs that have been amended by the SNFPA, which was finalized in 2004 (USDA 2000, volume 3, chapter 3, part 4.4.1, pp. 2–18; USDA 2001, entire; USDA 2004, entire). The SNFPA requires fire and fuels management projects in most areas to retain at least 40 percent (preferably 50 percent) canopy cover within a treatment unit, and effectively requires retention of trees 63.5 cm (25 in) diameter at breast height (dbh) in most treated areas (USDA 2004, pp. 3, 50). This is close to the preferred winter habitat characteristics discussed above for the Lassen Sighting area (60 cm (23.6 in) dbh and 40 percent or greater canopy closure). SNFPA Standard and Guideline #32 requires the Forest Service to conduct an analysis to determine whether activities within 8 km (5 mi) of a verified Sierra Nevada red fox sighting have the potential to affect the species (USDA 2004, p. 54). It also mandates a limited operating period of January 1 to June 30 as necessary to avoid adverse impacts to potential breeding, and it requires 2 years of evaluations for activities near sightings that are not associated with a den site.

Additionally, in accordance with the requirements of the SNFPA, vehicle use that may impact Sierra Nevada red fox is managed to a limited extent to reduce potential impacts to Sierra Nevada red fox (*e.g.*, limiting OHV use to designated OHV use areas and trails, limiting snowmobile use in the Sonora Pass sighting area to a designated BWRA area). All Oregon sighting areas include roads and snowmobile trails, though the relative areas devoted to such use differ. Those areas with off-road, regulated travel include:

(1) Mt. Hood sighting area is mostly designated wilderness, although a few off-highway vehicle (OHV) trails exist near Sierra Nevada red fox sightings at lower elevations.

(2) The Mt. Washington sighting area has many miles of snowmobile and OHV trails.

(3) The Dutchman Flat sighting area harbors numerous snow-parks, with many miles of snowmobile and OHV trails.

(4) Willamette Pass is a high-use recreational area at all times of the year, including extensive use of snowmobiles, and snow groomers at the Willamette pass Ski Area; the effects to the local

Sierra Nevada red fox population are unknown at this time.

(5) The Lassen National Forest prohibits wheeled vehicle travel except on designated routes and limited OHV use areas (USDA 2009, pp. iii, 461).

Additionally, National Forest's LRMPs that are covered by the SNFPA (Klamath, Shasta-Trinity, Lassen, Tahoe, El Dorado, Stanislaus, Sierra, Inyo, and Sequoia National Forests) or within the Intermountain Region (Humboldt-Toiyabe National Forest) provide direct and indirect protections to Sierra Nevada red fox and their habitat (e.g., implementing fuels reduction activities to reduce the likelihood of overly large, high-severity wildfire) beyond those National Forests that limit OHV and snowmobile vehicle activity.

Finally, the Omnibus Public Land Management Act of 2009 (OPLMA) (Pub. L. 111–11, p. 1059) establishes the Bridgeport Winter Recreation Area for control of winter vehicles on Forest Service land, consisting of about 2,833 ha (7,000 ac) in the northern portion of the Sonora Pass sighting area (USDA 2010, p. 4). The OPLMA states that the winter use of snowmobiles is allowed in the Recreation Area, subject to terms and conditions established by the Secretary of Agriculture. Prior to passage of the OPLMA, the area had been under consideration for designation as wilderness, although snowmobile use had been allowed in the area since 2005 (USDA 2010, pp. 3–4). The Forest Service has completed a management plan that calls for monitoring of impacts to wildlife (USDA 2010, p. 9), and is proceeding with evaluations of impacts to Sierra Nevada red fox in accordance with Standard 32 from the SNFPA (see *Vehicles*, above).

National Park Service

Statutory direction for the National Park Service lands that overlap the Sierra Nevada red fox's range is provided by provisions of the National Park Service Organic Act of 1916, as amended (16 U.S.C. 1 *et seq.*) and the National Park Service General Authorities Act of 1970 (16 U.S.C. 1a–1). Natural resources are managed to “preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities” (USDI NPS 2006, p. 36). Land management plans for the National Parks do not contain specific measures to protect Sierra Nevada red fox or their habitat, but areas not developed specifically for recreation and camping are managed toward natural processes and species composition and are expected to

maintain Sierra Nevada red fox habitat. Prescribed fire is often used as a habitat management tool by the Park Service. The effects of these burns on the subspecies have not been directly studied, the best available data do not indicate direct mortality to red foxes from fires, and fuels reduction through prescribed fire will likely benefit Sierra Nevada red fox in the long term by reducing the threat of Sierra Nevada red fox habitat loss (Truex and Zielinski 2013, p. 90; Zielinski 2014, pp. 411–412). Additionally, hunting and trapping are generally prohibited in National Parks, which is the case at both Crater Lake and Lassen Volcanic National Parks where Sierra Nevada red fox are known to reside.

State

Oregon

Sierra Nevada red fox in Oregon may be hunted and trapped, including with use of dogs (635 Oregon Administrative Rules 050–0045(1), 0045(8)). As discussed above (see *Trapping or Hunting*, above, and the “Hunting and Trapping” section of the Species Report (Service 2015, pp. 32–34)), actual impacts to Sierra Nevada red fox are difficult to determine because of record-keeping conventions, but likely to be relatively low because relatively few red fox (some of which may be Sierra Nevada red fox) are removed from an unknown number of populations as a result of fur trapping in Oregon, and we have no evidence to suggest that the subspecies is in decline as a consequence of fur trapping.

California

The CESA (CFGC 2050 *et seq.*) prohibits possession, purchase, or “take” of threatened or endangered species without an incidental take permit, issued by CDFW. The Sierra Nevada red fox was designated as a threatened species under CESA in 1980 (CDFW 2014, p. 12). Therefore, CESA establishes protections to Sierra Nevada red fox by emphasizing early consultation to avoid potential impacts to the subspecies, and to develop appropriate mitigation planning to offset project caused losses associated with the listed subspecies.

The State of California classifies red foxes as a furbearing mammal that is protected from commercial harvest (14 California Code of Regulations (C.C.R.) 460), and provides protection to Sierra Nevada red foxes in the form of fines between \$300 and \$2,000, and up to a year in jail for illegal trapping (114 C.C.R. 465.5(h)). Body-gripping traps are also generally prohibited in California,

so accidental harvest of Sierra Nevada red fox incidental to legal trapping of other species is unlikely (see *Trapping or Hunting*, above). Between 2000 and 2011, approximately 150 trapping permits were sold annually in California; thus, the effects of legal trapping to all species combined are probably low (Callas 2013, p. 6). Licensed trappers must pass a trapping competence and proficiency test and must report their trapping results annually. Scientists who are trapping Sierra Nevada red foxes for research purposes must obtain a memorandum of understanding from the State (California Fish and Game Code, sections 1002 and 1003, and section 650). Additionally, strict trapping and handling protocols must be adhered to by researchers to ensure the safety of study animals.

Summary of Existing Regulatory Mechanisms

Overall, existing Federal and State land-use plans include some general conservation measures for northern spotted owl habitat that are not specific to Sierra Nevada red fox but nonetheless provide a benefit to the subspecies, for example through the maintenance and recruitment of late-successional forest and old-growth habitat. Most management plans address structural habitat features (e.g., snags that could be utilized as denning structures) or land allocations (e.g., reserves, wilderness areas) that contribute to the Sierra Nevada red fox's habitat. These land-use plans are typically general in nature and afford relatively broad latitude to land managers, but with explicit sideboards for directing management activities. Federal regulatory mechanisms have abated the large-scale loss of late-seral coniferous forest habitat. Much of the land in Federal ownership across the range of the Sierra Nevada red fox is managed for interconnected blocks of late-successional forests that are likely to benefit the Sierra Nevada red fox. Timber harvest has been substantially reduced on Forest Service lands within the NWFP area, and does not occur on National Park Service lands, and existing management is designed to maintain or increase the amount and quality of coniferous forest that provides Sierra Nevada red fox habitat, including the ability of these areas to potentially help connect populations of the subspecies. Outside of public (Federal) ownership, forest practice rules provide no explicit protection for Sierra Nevada red fox; however, there are limited protections for habitat of value to the subspecies.

Based on the analyses contained within the Species Report (Service 2015,

pp. 58–63) and summarized above on the existing regulatory mechanisms for the Sierra Nevada red fox, we conclude that the best available scientific and commercial information, overall, indicates that the existing regulatory mechanisms are adequate to address impacts to the subspecies from the stressors for which governments may have regulatory control (*i.e.*, wildfire and fire suppression (*Factor A*), injury or mortality due to fur trapping (*Factor B*), and collision with vehicles (*Factor E*)).

Conservation Efforts

Because the Sierra Nevada red fox has only been documented to date to occur on Forest Service and NPS lands, primary conservation actions currently fall to those land management agencies, as well as the States. Various conservation and management efforts have been occurring since approximately 1974, including: (1) Significant subspecies-specific protections in California from hunting and trapping as a California-stated listed species in 1980; (2) minimized impacts from various stressors by the Forest Service as a result of its sensitive species designation in California (since 1998) and Oregon (since 2015); and (3) National Park Service protections at the Lassen and Crater Lake sighting areas associated with their requirement to “preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities” (USDI NPS 2006, p. 36). All beneficial conservation or management actions are described above and in the Species Report (Service 2015, p. 63) and under the *Existing Regulatory Mechanisms* section, above. We also note that we anticipate coordinating with our Federal and State partners in the future if we collectively determine that translocation of Sierra Nevada red fox individuals to different populations are prudent to aid in the conservation of the subspecies.

Finding

As required by the Act, we considered the five factors in assessing whether the Sierra Nevada red fox is an endangered or threatened species throughout all of its range. We examined the best scientific and commercial data available regarding the past, present, and future stressors faced by the Sierra Nevada red fox. We reviewed the petition, information available in our files, and other available published and unpublished information, and we consulted with recognized Sierra Nevada red fox and habitat experts, and other Federal and State agencies. Listing

is warranted if, based on our review of the best available scientific and commercial data, we find that the stressors to the Sierra Nevada red fox are so severe or broad in scope as to indicate that the subspecies is in danger of extinction (endangered), or likely to become endangered within the foreseeable future (threatened), throughout all or a significant portion of its range.

For the purposes of this evaluation, we are required to consider potential impacts to the Sierra Nevada red fox into the foreseeable future. Based on the best available scientific and commercial information and to provide the necessary temporal context for assessing stressors to Sierra Nevada red fox, we determined 50 years to be the foreseeable future because the likelihood and severity of future impacts became too uncertain to address beyond a 50-year timeframe (see examples and further discussion for this time period in the general discussion above under Summary of Information Pertaining to the Five Factors).

We evaluated each of the potential stressors in the Species Report (Service 2015, pp. 21–58) for the Sierra Nevada red fox, and we determined that the following are factors that have either minimally impacted individuals, impacted one or more sighting areas (or known populations), or may potentially impact individuals, sighting areas, or known populations in the future: wildfire and fire suppression (*Factor A*), habitat impacts due to the effects of climate change (*Factor A*), trapping (for fur and research purposes) (*Factor B*), disease (*Factor C*), predation (*Factor C*), hybridization with nonnative red fox (*Factor E*), competition with coyotes (*Factor E*), collisions with vehicles (*Factor E*), and small and isolated population size effects (*Factor E*). Our analysis resulted in the following conclusions for each of the stressors:

- *Wildfire or fire suppression* impacts may occur throughout the range of the Sierra Nevada red fox. There may be an overall increased risk of wildfire, as demonstrated by recent occurrence of wildfires and potential predictions into the future related to temperature and precipitation (see *Climate Change*). At this time, there are no reports of direct mortality to red foxes from wildfires, and wildfires can improve habitat for red foxes by removing competing vegetation and encouraging production of grasses and shrubs favored by small mammals (Tesky 1995, p. 7), which the Sierra Nevada red fox depends upon as a prey base. Accordingly, these potential impacts are balanced with the potential benefits, thus resulting in our

consideration of wildfire and fire suppression to constitute an overall low-level impact that does not rise to the level of a threat both currently and into the future.

- The severity of potential *climate change* impacts to Sierra Nevada red fox habitat will likely vary across its range, with effects to the subspecies potentially ranging from negative to neutral. Although many climate models generally agree about the changes in overall temperature and precipitation (the latter as it relates to precipitation falling potentially more as rain as opposed to snow at some upper elevations), the consequent effects on the landscape are more uncertain, as is the rate at which any such changes might be realized. Therefore, it is not clear how or when changes in snowpack at the upper elevations will affect the distribution of Sierra Nevada red fox or coyotes, the latter of which may compete or predate upon the subspecies. Overall, we lack sufficient information to predict with any certainty the future direct or indirect impacts of climate change on Sierra Nevada red fox habitat or populations. Consequently, we have determined that we do not have reliable information to suggest that climate change rises to the level of a threat to the Sierra Nevada red fox now or in the future (*i.e.*, conditions are not expected to change to a degree that would be considered significant within the next 50 years), although we will continue to seek additional information concerning how climate change may affect Sierra Nevada red fox habitat.

- *Trapping or hunting* for Sierra Nevada red fox fur has no impact to the subspecies in California because trapping for Sierra Nevada red fox is illegal in California. Possible illegal fur trapping in California, as well as statewide potential impacts associated with live-trapping for research purposes or incidental trapping of Sierra Nevada red fox (when intentionally trapping for other furbearer species), is not expected to result in population-level impacts. Some Sierra Nevada red fox could be trapped in Oregon where fur trapping for all red fox subspecies is legal, although we estimate that potential impacts will not be significant at the population- or statewide-level based on the best available trapping data for Oregon. Additionally, potential impacts to Sierra Nevada red fox from live-trapping and handling for research purposes is discountable because the best available data indicate that no Sierra Nevada red fox have been injured or killed during research-related live-trapping efforts. Available information

does not suggest that there would be any change to the level of anticipated impacts of live-trapping and handling for research purposes into the future. Thus, impacts from fur trapping and trapping for research purposes across the Sierra Nevada red fox's range do not rise to the level of a threat.

- *Disease* has not been documented within Sierra Nevada red fox individuals or the known populations. The prevalence of possible past exposure to lethal pathogens within the subspecies has not been determined, and we have no information to suggest that disease is currently present in any portion of the subspecies' range. At this point in time, there is a low probability that a disease outbreak may occur. We anticipate that if there should be an outbreak, it would likely have a low impact on all seven sighting areas combined since the distance between those sighting areas makes it unlikely that an outbreak would spread to all seven sighting areas. Thus, disease does not rise to the level of a threat.

- *Predation* is possible by both domestic dogs and coyotes, the latter of which could also potentially include *competition with coyotes* for resources. For domestic dogs, although one documented case of a dog attack on Sierra Nevada red fox (resulting in death) has occurred, data indicate that predation by dogs is not expected to increase in the future based on our evaluation of recent information. Thus, population-level or subspecies-level effects to Sierra Nevada red fox are not likely to occur both currently or in the future. For coyotes, predation and competition have an overall medium-level impact to the Sierra Nevada red fox due to:

(a) The presence of coyotes co-occurring at multiple sighting areas within the subspecies' range.

(b) The potential for increased predation in the Crater Lake, Lassen, and Sonora Pass sighting areas into the future given climate model projections of decreased snowpack levels that may make the habitat more favorable to coyotes.

(c) The overall inability of the populations at those three locations to shift up in elevation.

However, the best available data indicate that predation and competition are not impacting the Sierra Nevada red fox at the subspecies-level to the degree that any more than individuals at a couple sighting areas may be affected both currently and into the future. Additionally, there is no indication that potential future changes in snowpack levels or shifting habitat at high elevations (as suggested by climate

models) would occur within the next 50 years to such a degree that coyote numbers would increase throughout the subspecies' range to the point that coyote predation or competition would rise to the level of a threat.

- *Hybridization with nonnative red fox* has been documented to occur in two sighting areas, although one (Mt. Hood) is a genetic record indicating hybridization at some point in the past. Recent hybridization was documented at the Sonora Pass sighting area based on recent research in a portion of the sighting area. Hybridization involved interbreeding between female Sierra Nevada red fox and two male nonnative red foxes, which resulted in seven hybrid pups in 2013, followed by an additional four hybrid pups in 2014 (Sacks *et al.* 2015, pp. 16, 30). Although interbreeding is documented, it is only known to be a current impact within a portion of one sighting area across the subspecies' range. At this time, based on the best available scientific and commercial information, this stressor does not rise to the level of a threat because information indicates hybridization is currently occurring within a portion of only one sighting area across the subspecies' range. We have no information to indicate this level of impact will increase across the subspecies' range in the future.

- Potential *vehicle impacts* include both collisions and noise disturbance. Collisions with vehicles are rare, but they can be expected into the future. Known rates of mortality due to collisions with vehicles have been low for Sierra Nevada red fox, and the best available information does not suggest increases in vehicular traffic or roads to be built in areas where the subspecies occurs. In addition to collisions, Sierra Nevada red fox could be impacted from noise disturbance associated with recreational areas; however, the magnitude of impacts from noise is unknown, and the location of the subspecies' sightings in these areas suggest that they adjust to the noise involved. Overall, it is reasonable to expect the impact of vehicles on Sierra Nevada red fox to be minor and continue at similar levels into the future, thus not rising to the level of a threat.

- *Small, isolated populations* are susceptible to inbreeding depression, and are more susceptible to losses from other stressors. Therefore, we evaluated whether the Sierra Nevada red fox may have small and isolated populations where these negative effects are likely to be realized. At this time, evidence suggests that Sierra Nevada red fox distribution (and likely numbers of

individuals) has contracted from the past in California. This contraction cannot be determined with certainty for Oregon given the Sierra Nevada red fox's range in the Oregon Cascades is a recent discovery since publication of the 90-day finding (77 FR 45; January 3, 2012). We note that the Sierra Nevada red fox rangewide distribution and possibly abundance may have declined at some point in the past based on historical trapping numbers (Grinnell *et al.* 1937, p. 389; Schempf and White 1977, p. 44) compared to our current knowledge of the subspecies' abundance and distribution, where available. The abundance, trend, and numbers of Sierra Nevada red fox populations in Oregon are unknown, although recent surveys within the Oregon Cascades are documenting the presence of Sierra Nevada red fox. Although the known sighting areas are disjunct, the dispersal capabilities of Sierra Nevada red fox suggest the potential for interchange of individuals between sighting areas, with the exception of the Sonora Pass sighting area where genetic analysis reveals a clear separation and lack of breeding with the next closest northern Sierra Nevada red fox population in the Lassen sighting area. The best available data at this time indicate that although Sierra Nevada red fox may be reduced in abundance or distribution relative to their historical numbers and range, there is no empirical evidence that any current populations of Sierra Nevada red fox in Oregon are in decline. Thus, small or isolated population size effects when considering the subspecies across its entire range do not rise to the level of a threat either currently or in the foreseeable future.

- Potential *cumulative impacts* to the Sierra Nevada red fox are possible; however, the most likely scenarios for cumulative impacts are likely to only occur from the following two scenarios: (1) Potential increased competition with and predation by coyotes on Sierra Nevada red fox as a result of high-elevation areas becoming more suitable for coyotes as a result of climate change; and (2) a combination of potential stressors (*i.e.*, hunting and trapping in Oregon, SPD and other diseases, competition and predation from coyotes, hybridization with nonnative red fox, vehicles) that directly result in death or loss of reproductive ability for the Sierra Nevada red fox. Based on the best available data at this time and as described above, none of these possible cumulative impacts are likely to occur currently nor are they likely to increase or into the foreseeable future to such a degree that the effects are expected to

lead to or rangewide-level declines. Therefore, the cumulative impact of these potential stressors does not rise to the level of a threat.

We also evaluated existing regulatory mechanisms (*Factor D*) and did not determine an inadequacy of existing regulatory mechanisms for the Sierra Nevada red fox. Specifically, we found that multiple Federal land use plans (e.g., LRMPs, NWFP, SNFPA), plus State regulations in California that prevent hunting/trapping of Sierra Nevada red fox, are being implemented, often providing broad latitude for land managers, but with explicit sideboards for directing management activities. We note that significant Federal efforts have been developed and are being implemented (e.g., NWFP) to abate the large-scale loss of forested habitat-types that the Sierra Nevada red fox depends upon. Beneficial management efforts of habitat occupied by Sierra Nevada red fox are also underway on Forest Service and NPS lands that currently constitute the entire area known to be occupied by Sierra Nevada red fox, which in turn will promote further recruitment of such suitable habitat.

None of these impacts, as summarized above, was found to individually or cumulatively impact the Sierra Nevada red fox to a degree such that listing is warranted at this time. Based on the analysis contained within the Species Report (Service 2015, pp. 21–58), we conclude that the best available scientific and commercial information indicates that these stressors are not singly or cumulatively causing a decline of the Sierra Nevada red fox or its habitat currently, nor are the stressors likely to be significant in the foreseeable future to the degree that they would result in declines of multiple populations (represented by the seven sighting areas) such that the subspecies would be in danger of extinction, or likely to become so within the foreseeable future.

We recognize a need to continue to monitor the Sierra Nevada red fox throughout its range because the currently known sighting areas are disjunct (with an unknown number of populations in Oregon), which in general could make them more susceptible to stressors than species with large, well-connected populations. There has been relatively little survey effort specifically for Sierra Nevada red fox in portions of its range (e.g., Mt. Shasta vicinity, are extending southward along the Sierra Nevada from the Yosemite National Park area), as opposed to general carnivore surveys, which may not be sufficient to accurately determine presence/absence

of Sierra Nevada red fox. As indicated above, survey efforts are underway throughout Oregon at the time of the publication of this document. In general, the interchange of only a few individuals is needed to maintain genetic connectivity between populations over time. As described in this document and the Species Report (Service 2015, entire), there are stressors that we find may be having some effect on Sierra Nevada red foxes, albeit not to the degree that they currently rise to the level that listing the entire subspecies is warranted. We will continue to monitor the status of the subspecies and evaluate any other information we receive. Additional information will continue to be accepted on all aspects of the subspecies. If at any time data indicate that protective status under the Act should be provided or if there are new threats or increasing stressors that rise to the level of a threat, we can initiate listing procedures, including, if appropriate, emergency listing pursuant to section 4(b)(7) of the Act.

In conclusion, we acknowledge that the Sierra Nevada red fox populations in California (and possibly Oregon) may be reduced in size relative to their historical abundance, and that the subspecies may be reduced in distribution as compared to its historical range. A listing determination, however, must be based on our assessment of the current status of the subspecies in relation to the five listing factors under the Act. Section 4 of the Act requires that we make such a determination based solely on the best scientific and commercial data available. To this end, we must rely on reasonable conclusions as supported by the best available science to assess the current and future status to determine whether the Sierra Nevada red fox meets the definition of an endangered or threatened species under the Act. Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the stressors acting upon the Sierra Nevada red fox are not of sufficient imminence, intensity, or magnitude to indicate that the subspecies is in danger of extinction now (endangered), or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range

Under the Act and our implementing regulations, a species may warrant listing if it is an endangered or a threatened species throughout all or a significant portion of its range. The Act defines “endangered species” as any species which is “in danger of

extinction throughout all or a significant portion of its range,” and “threatened species” as any species which is “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” The term “species” includes “any subspecies of fish or wildlife or plants, and any distinct population segment [DPS] of any species of vertebrate fish or wildlife which interbreeds when mature.” We published a final policy interpreting the phrase “Significant Portion of its Range” (SPR) (79 FR 37578; July 1, 2014). The final policy states that (1) if a species is found to be an endangered or a threatened species throughout a significant portion of its range, the entire species is listed as an endangered or a threatened species, respectively, and the Act’s protections apply to all individuals of the species wherever found; (2) a portion of the range of a species is “significant” if the species is not currently an endangered or a threatened species throughout all of its range, but the portion’s contribution to the viability of the species is so important that, without the members in that portion, the species would be in danger of extinction, or likely to become so in the foreseeable future, throughout all of its range; (3) the range of a species is considered to be the general geographical area within which that species can be found at the time the Service or NMFS makes any particular status determination; and (4) if a vertebrate species is an endangered or a threatened species throughout an SPR, and the population in that significant portion is a valid DPS, we will list the DPS rather than the entire taxonomic species or subspecies.

The SPR Policy is applied to all status determinations, including analyses for the purposes of making listing, delisting, and reclassification determinations. The procedure for analyzing whether any portion is an SPR is similar, regardless of the type of status determination we are making. The first step in our analysis of the status of a species (“species” under the Act refers to any listable entity, including species, subspecies, or DPS) is to determine its status throughout all of its range. If we determine that the species is in danger of extinction, or likely to become so in the foreseeable future, throughout all of its range, we list the species as an endangered (or threatened) species and no SPR analysis is required. If the species is neither an endangered nor a threatened species throughout all of its range, we determine whether the species is an endangered or a threatened species

throughout a significant portion of its range. If it is, we list the species as an endangered or a threatened species, respectively; if it is not, we conclude that listing the species is not warranted.

When we conduct an SPR analysis, we first identify any portions of the species' range that warrant further consideration. The range of a species can theoretically be divided into portions in an infinite number of ways. However, there is no purpose to analyzing portions of the range that are not reasonably likely to be significant and either endangered or threatened. To identify only those portions that warrant further consideration, we determine whether there is substantial information indicating that (1) the portions may be significant, and (2) the species may be in danger of extinction in those portions or likely to become so within the foreseeable future. We emphasize that answering these questions in the affirmative is not a determination that the species is an endangered or a threatened species throughout a significant portion of its range—rather, it is a step in determining whether a more detailed analysis of the issue is required. In practice, a key part of this analysis is whether the threats are geographically concentrated in some way. If the threats to the species are affecting it uniformly throughout its range, no portion is likely to warrant further consideration. Moreover, if any concentration of threats apply only to portions of the range that clearly do not meet the biologically based definition of “significant” (*i.e.*, the loss of that portion clearly would not be expected to increase the vulnerability to extinction of the entire species), those portions will not warrant further consideration.

If we identify any portions that may be both (1) significant and (2) endangered or threatened, we engage in a more detailed analysis to determine whether these standards are indeed met. The identification of an SPR does not create a presumption, prejudgment, or other determination as to whether the species in that identified SPR is an endangered or a threatened species. We must go through a separate analysis to determine whether the species is an endangered or a threatened species in the SPR. To determine whether a species is an endangered or a threatened species throughout an SPR, we will use the same standards and methodology that we use to determine if a species is an endangered or a threatened species throughout its range.

Depending on the biology of the species, its range, and the threats it faces, it may be more efficient to address the “significant” question first, or the

status question first. Thus, if we determine that a portion of the range is not “significant,” we do not need to determine whether the species is an endangered or a threatened species there; if we determine that the species is not an endangered or a threatened species in a portion of its range, we do not need to determine if that portion is “significant.”

We consider the historical range of the Sierra Nevada red fox to include: (1) The Southern Cascades (from the Columbia River at Mt. Hood south into California, including the area of Mt. Shasta and slightly into the Trinity Mountains, and continuing south to the Lassen Peak area), and (2) the Sierra Nevada (the upper elevations of the Sierra Nevada Mountain Range from Sierra to Tulare Counties). This range includes those mountainous areas that exceed 1,200 m (3,937 ft) in California (Perrine *et al.* 2010, p. 8) and 1,219 m (4,000 ft) in Oregon (Aubry *et al.* 2015, pp. 1–2; Doerr 2015, pp. 2–3, 13–144, line 7). Based on the best available information at this time, the seven sighting areas described above account for the current distribution of the subspecies.

In considering any significant portion of the Sierra Nevada red fox's range, we considered whether the stressors facing the subspecies might be different at the seven sighting areas where the Sierra Nevada red fox has been found and, thus, geographically concentrated in some portion of the subspecies' range. In the Summary of Information Pertaining to the Five Factors analysis, above, we identified the most likely potential differences associated with trapping or hunting for fur, hybridization with nonnative red fox, and coyote predation or competition (and its association with climate change).

(1) Trapping or hunting for fur is legal in Oregon, and thus four Oregon sighting areas may be affected by this activity. Population-level impacts of legal Sierra Nevada red fox fur trapping within the four Oregon sighting areas have not been studied, as the impact of trapping on a red fox population requires an estimate of population abundance, which is currently unavailable for Sierra Nevada red fox within the Oregon Cascades. Based on the very few red fox (lowland red fox or other subspecies) being harvested across the counties that overlap the Sierra Nevada red fox sighting areas, the best available data indicate that fur trapping is unlikely to result in population-level impacts across a significant portion of the subspecies' range.

Fur trapping of Sierra Nevada red fox is illegal in California but legal for other furbearer species. We expect that nearly all Sierra Nevada red fox that are accidentally captured in box traps set for other furbearer species (or that are live-trapped for research purposes) are released unharmed. Although illegal fur trapping specifically for Sierra Nevada red fox is also a possibility in California, the best available data at this time do not indicate that illegal fur trapping or incidental legal live-trapping for the subspecies for research purposes is resulting in population-level impacts. Overall, we do not find that the potential impacts from fur trapping (illegal or legal) and live-trapping for research purposes are geographically concentrated in any one portion of the Sierra Nevada red fox's range. Moreover, we do not find that that trapping rises to the level of a threat to the species, and therefore it is unlikely that the Sierra Nevada red fox would be found to be endangered or threatened in any portion of its range as a result of trapping.

(2) Only two sighting areas (Mt. Hood and Sonora Pass) show evidence of hybridization with nonnative red fox. However, there are no geographic barriers preventing nonnative red fox from interacting with Sierra Nevada red fox throughout the remainder of the subspecies' range. At the Mt. Hood sighting area, two Sierra Nevada red fox individuals show evidence (via genetic testing of mtDNA) of past hybridization with nonnative red foxes (Akins and Sacks 2015, p. 1). At a portion of the Sonora Pass sighting area, interbreeding between female Sierra Nevada red fox and two male nonnative red foxes resulted in seven hybrid pups in 2013, and an additional four pups in 2014 (Quinn and Sacks 2014, pp. 2, 10). During the same time period, no successful fully native reproduction was documented. If this trend continues, then the Sonora population could become completely hybridized within a few generations, potentially resulting in outbreeding depression and genetic swamping.

To date, the best available data indicate that hybridization with nonnative red fox has impacted a few individuals at two locations. Future hybridization could occur at these two or other locations, and therefore we do not anticipate a concentration of this stressor in any one portion of the subspecies' range.

(3) The presence of coyotes is likely to continue in most if not all areas throughout the range of the Sierra Nevada red fox, and may potentially result in elevated levels of predation

and competition in the future if climate change predictions become realized. The potential impacts from climate change could result in reduced snowpack and vegetation changes, which in turn could result in habitat conditions more suitable for coyotes, thus potentially increasing the level of coyote predation or competition. These impacts may be more pronounced at the Crater Lake, Lassen, and Sonora Pass sighting areas as compared to the remainder of the Sierra Nevada red fox's sighting areas due to the subspecies already occupying the highest elevations at Crater Lake and Lassen sighting areas, and the subspecies already occupying a relatively narrow elevational range at the Sonora Pass sighting area. At this time, it is not clear how finer-scale abiotic factors may shape local climates and influence local snowpack levels and vegetation trends either to the benefit or detriment of Sierra Nevada red fox, nor is the timeframe clear over which these influences may be realized.

Although information on coyote predation is not available at all three sighting areas, we note that Perrine (2005, p. 192) found coyote population density at the Lassen sighting area to be greater at lower elevations, thus producing an elevational separation between most coyotes and the Sierra Nevada red fox population. It is reasonable to assume this same type of elevational separation exists at the Crater Lake and Sonora Pass sighting areas, and that it may continue into the foreseeable future. Additionally, the Sierra Nevada red fox's main winter food source at the Lassen study site was small rodents rather than the coyote's preference of deer (Perrine 2005, p. 24); thus, the Sierra Nevada red fox tended to stay at higher elevations than coyotes, thereby reducing potential predation and competition. Although potential future climate change impacts could promote conditions for coyotes numbers to increase at the higher elevations (particularly in certain sighting areas), we believe this change is speculative at this time.

We also note that two packs of gray wolves have recently become established in the southern portion of the Oregon Cascades in Oregon and California, and it is reasonable to predict continued repopulation of wolves to the Cascades (currently occurring between the Lassen and Crater Lake sighting areas, approximately 24 km (15 mi) south of the Crater Lake sighting area). Presence of wolves would likely lower coyote population numbers or exclude them from higher elevation forested areas, thereby facilitating the

persistence of nearby Sierra Nevada red fox populations (Levi and Wilmers 2012, p. 926). Wolves are also not expected to significantly impact the Sierra Nevada red fox given they typically prey upon and compete with larger game (ODFW 2015, p. 2). Given that (1) ODFW's current conservation objectives for the wolf include establishment of seven breeding pairs in western Oregon for 3 consecutive years (ODFW 2010, p. 17), and (2) the likelihood that CDFW (in cooperation with the Service) would develop a beneficial conservation strategy for wolves in California, we consider it likely that the current wolf populations will expand over the next 50 years to effectively overlap other portions of the Sierra Nevada red fox's historical range in Oregon and California in the foreseeable future, thus potentially contributing to natural coyote control within the Sierra Nevada red fox's range.

Overall, based on the best available scientific and commercial information at this time, we do not anticipate a geographic concentration of threats in one or more sighting areas at a level greater than any other (*i.e.*, potential impacts associated with climate change and coyote predation/competition appear uniformly distributed throughout the subspecies' range). At this time, there is significant uncertainty as to the severity of impact, and data do not indicate that coyote populations will, with certainty, increase as a result of climate change into the foreseeable future at a level greater than any other in any one portion of the range of the subspecies.

In summary, our evaluation of the best available information indicates that the overall level of stressors is not geographically concentrated in one portion of the Sierra Nevada red fox's range, and that the stressors that have the potential to impact the subspecies are relatively consistent across its range (Service 2015, entire). Our review of the best available scientific and commercial information indicates that the Sierra Nevada red fox is not in danger of extinction (endangered) nor likely to become endangered within the foreseeable future (threatened), throughout all or a significant portion of its range. Therefore, we find that listing the Sierra Nevada red fox as an endangered or threatened species under the Act is not warranted at this time.

Distinct Population Segment (DPS) Analysis

Citing the Services' DPS Policy (61 FR 4722) and the best available information at the time, the April 27, 2011, petition

from the Center for Biological Diversity (CBD 2011, pp. 7–8) suggests two potential DPSs within the range of the Sierra Nevada red fox (as originally described by Perrine *et al.* 2010 and Sacks *et al.* 2010a): a Southern Cascade population in the Cascades Mountains of northern California and Oregon, and a Sierra Nevada population in the Sierra Nevada Mountains. The petitioner stated that they believe the full subspecies (comprised of both distinct segments) should be listed, although we note that this statement was made prior to the discovery of new information documenting the Sierra Nevada red fox subspecies inhabiting the entire Oregon Cascades area as far north as Mt. Hood (see *Summary of Species Information*, above). Further, the petitioner articulated that the Service should assess whether the [then known] two populations (*i.e.*, Lassen and Sonora Pass) qualify as DPSs under the Act.

As a result of the new information received following publication of the 90-day finding (77 FR 45; January 3, 2012), and as described above under *Summary of Species Information—Distribution/Range*, we evaluate here a potential Southern Cascades DPS that includes the Cascade Mountains of Oregon from the Columbia River south into the California Cascades around Lassen Peak (including the area of Mt. Shasta, primarily in the Cascades but extending slightly into the Trinity Mountains), and a potential Sierra Nevada DPS that includes the upper elevations of the Sierra Nevada Mountain Range from Tulare to Sierra Counties. The best available information indicates that Sierra Nevada red fox occurs discontinuously throughout these mountainous areas at elevations that exceed 1,200 m (3,937 ft) in California (Perrine *et al.* 2010, p. 8) and 1,219 m (4,000 ft) in Oregon (Aubry *et al.* 2015, pp. 1–2; Doerr 2015, pp. 2–3, 13–14, line 7).

Section 3(16) of the Act defines the term “species” to include any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature. We have always understood the phrase “interbreeds when mature” to mean that a DPS must consist of members of the same species or subspecies in the wild that would be biologically capable of interbreeding if given the opportunity, but all members need not actually interbreed with each other. A DPS is a subset of a species or subspecies, and cannot consist of members of a different species or subspecies. The “biological species concept” defines species according to a group of organisms, their

actual or potential ability to interbreed, and their relative reproductive isolation from other organisms. This concept is a widely accepted approach to defining species. We believe that the Act's use of the phrase "interbreeds when mature" reflects this understanding. Use of this phrase with respect to a DPS is simply intended to mean that a DPS must be comprised of members of the same species or subspecies. As long as this requirement is met, a DPS may include multiple populations of vertebrate organisms that may not interbreed with each other. For example, a DPS may consist of multiple populations of a fish species separated into different drainages. While these populations may not actually interbreed with each other, their members are biologically capable of interbreeding.

The National Marine Fisheries Service (NMFS) and the Service published a joint Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act (DPS Policy) on February 7, 1996 (61 FR 4722). According to the DPS policy, two elements must be satisfied in order for a population segment to qualify as a possible DPS: discreteness and significance. If the population segment qualifies as a DPS, the conservation status of that DPS is then evaluated to determine whether it is endangered or threatened.

A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors; or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

If a population is found to be discrete, then it is evaluated for significance under the DPS policy on the basis of its importance to the taxon to which it belongs. This consideration may include, but is not limited to, the following: (1) Persistence of the discrete population segment in an ecological setting unusual or unique to the taxon; (2) evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon; (3) evidence that the population represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside of its historical range; or (4) evidence that the population differs markedly from other

populations of the species in its genetic characteristics.

If a population segment is both discrete and significant (*i.e.*, it qualifies as a potential DPS) its evaluation for endangered or threatened status is based on the Act's definitions of those terms and a review of the factors listed in section 4(a) of the Act. According to our DPS policy, it may be appropriate to assign different classifications to different DPSs of the same vertebrate taxon. For this 12-month finding and DPS analysis of the Sierra Nevada red fox, we reviewed and evaluated information contained in numerous publications and reports, including but not limited to Aubry 1997, Grinnell *et al.* 1937, Perrine 2005, Perrine *et al.* 2010, Sacks *et al.* 2010a, Sacks *et al.* 2015, Schempf and White 1977, and Statham *et al.* 2012.

Discreteness

The best available data indicate spatial separation between the Sierra Nevada red foxes that occur in the Southern Cascades and Sierra Nevada Mountain Ranges. The mountain ranges themselves are geologically divided, and currently a large separation exists between the nearest known populations (Lassen and Sonora Pass) in these two ranges. The distance separating the Lassen and Sonora Pass sighting areas is approximately 150 km (93 mi), which is greater than the dispersal distance known from one study of red fox in the Midwest, where 95 percent of the juvenile American Midwest red fox dispersed less than approximately 80 km (50 mi) in their first year (Perrine *et al.* 2010, pp. 14–15).

In addition to marked separation (*i.e.*, spatial separation) that currently exists between the Sierra Nevada red fox in the Southern Cascades and Sierra Nevada Mountain Ranges, genetic research shows that the Lassen and Sonora Pass populations (representing the Southern Cascades and Sierra Nevada population segments, respectively) are genetically distinct from each other (Statham *et al.* 2012, pp. 129–130). Analyses using both mtDNA and microsatellites indicate that Sierra Nevada red fox at the Sonora Pass sighting area are descendants of the Sierra Nevada red fox population that was historically resident in the Sierra Nevada range (Statham *et al.* 2012, pp. 126–129). Lastly, genetic research indicates that there are no shared mitochondrial haplotypes between the Southern Cascades and Sierra Nevada populations, and there is no evidence of gene flow between the two populations (Statham *et al.* 2012, pp. 129–130).

In conclusion, the areas occupied by the Sierra Nevada red fox within the Southern Cascades and Sierra Nevada Mountain Ranges are separated by a geologic gap in the range. The best available data currently indicate this gap represents a lack of population connectivity between the two geographic areas. This separation is further supported by recent genetic studies which demonstrate that the two closest sighting areas (*i.e.*, known populations that reside at the Lassen and Sonora Pass sighting areas) show genetic differences, and there is no indication of gene flow between these populations. Therefore, we conclude that the two areas are discrete under our DPS policy.

Significance

If a population segment is considered discrete under one of more of the conditions described in our DPS policy, its biological and ecological significance will be considered in light of Congressional guidance that the authority to list DPSs be used "sparingly" while encouraging the conservation of genetic diversity. In making this determination and as described above, this consideration may include, but is not limited to, the following: (1) Persistence of the discrete population segment in an ecological setting unusual or unique to the taxon; (2) evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon; (3) evidence that the population represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside of its historical range; or (4) evidence that the population differs markedly from other populations of the species in its genetic characteristics.

The current known distribution of genetic variation across the range of the Sierra Nevada red fox places a disproportionate significance on both the Southern Cascades and Sierra Nevada segments for the maintenance of genetic diversity in the subspecies. As indicated above, the Sierra Nevada red fox differs markedly from other subspecies of red fox, and those that occur within the Sierra Nevada segment are genetically distinguishable from the Sierra Nevada red foxes that occur throughout the remainder of the subspecies range (Statham *et al.* 2012, pp. 129–130). Further, genetic analyses reveal that Sierra Nevada red fox at the Sonora Pass sighting area are descendants of the Sierra Nevada red fox population that was historically resident in the area (Statham *et al.* 2012,

pp. 126–129). In addition, different mtDNA haplotypes separate the Sierra Nevada red foxes that reside in the Southern Cascades from those that reside in the Sierra Nevada, indicating a lack of gene flow. Consequently, the loss of either the Southern Cascades or the Sierra Nevada segments could result in a significant curtailment of the genetic variation and diversity of the subspecies.

Additionally, the loss of the Sierra Nevada segment of the Sierra Nevada red fox's range would create a significant gap in the geographic range of the subspecies, given the southernmost known population within the Sierra Nevada Mountain range is approximately 241 km (150 mi) south of the next closest sighting area (Lassen) at the southern end of the Southern Cascades. If the Sierra Nevada Mountain Range segment of the subspecies' range was lost, this would result in an estimated 40 to 50 percent reduction in the range of the Sierra Nevada red fox. Likewise, the loss of the Southern Cascades segment of the subspecies' range would result in an estimated 50–60 percent reduction in the range of the Sierra Nevada red fox.

Overall, the two segments (Southern Cascades and Sierra Nevada) of the Sierra Nevada red fox's range differ markedly from each other and from other subspecies of red fox based on their genetic characteristics, and loss of either the Sierra Nevada segment or the Southern Cascades segment of the Sierra Nevada red fox's range would create a significant gap in the geographic range of the subspecies. Therefore, we conclude that the two areas are significant under our DPS policy.

Conclusion of Distinct Population Segment Review

We have evaluated as possible DPSs the populations of Sierra Nevada red fox from both the Southern Cascades Mountain Range and the Sierra Nevada Mountain Range, and we have addressed the elements our DPS policy requires us to consider in deciding whether a vertebrate population may be recognized as a DPS and considered for listing under the Act. In assessing discreteness for both segments, we considered geological, ecological, and genetic information. As described above, we have determined that both the Southern Cascades and Sierra Nevada segments of the Sierra Nevada red fox's range are both discrete and significant based on marked physical separation (discreteness) and genetic variation/characteristics (discreteness and significance). Our analysis reveals that the loss of the subspecies from either

segment of the Sierra Nevada red fox's range would represent: (1) A significant gap in the subspecies' range, and (2) the loss of genetic differences from Sierra Nevada red fox in the remainder of the subspecies range, as well as from other subspecies of red fox.

Since we have identified that the Southern Cascades segment and the Sierra Nevada segment of the Sierra Nevada red fox each meet the DPS criteria for discreteness and significance, we will evaluate each DPS with regard to their potential for listing as endangered or threatened using the five listing factors enumerated in section 4(a) of the Act (16 U.S.C. 1533(a)(1)). Our evaluation of these DPSs follows.

Southern Cascades Distinct Population Segment (DPS) of Sierra Nevada Red Fox

As described above, section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR part 424) describe procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a), we may list a species on the basis of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

An endangered species is defined by the Act, with exception, as “any species which is in danger of extinction throughout all or a significant portion of its range.” A threatened species is defined as “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” A species is defined by the Act to include any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.

An analysis of the potential threats for the Sierra Nevada red fox is included in the Species Report (Service 2015, entire) associated with this document (and available at <http://www.regulations.gov> under Docket No. FWS–R8–ES–2011–0103). All potential threats of which we are aware that may act upon the Southern Cascades DPS of Sierra Nevada red fox (hereafter referred to as Southern Cascades DPS) currently or in the future are captured within the Summary of Information Pertaining to the Five Factors section, above, and

stepped down in the following paragraphs as they pertain specifically to the Southern Cascades DPS. The range of the Southern Cascades DPS includes high-elevation alpine and subalpine zones near and above treeline (roughly greater than 1,200 m (3,937 ft) in California (Perrine *et al.* 2010, p. 8) and 1,219 m (4,000 ft) in Oregon (Aubry *et al.* 2015, pp. 2–3; Doerr 2015, pp. 2–3, 13–14, line 7) that contain conifer habitat of various types (Perrine 2005, pp. 63–64). These areas occur within the southern portion of the Cascades mountain range from the Columbia River just north of Mt. Hood (Hood River and Wasco Counties, Oregon) south to the Lassen Peak area (roughly the northeast corner of Tehama County and southeast corner of Shasta County, California). At this time, Sierra Nevada red fox are known to reside within a minimum of six locations across the range of the Southern Cascades DPS.

In comparison to the five-factor analysis presented above for the entire taxon, we are not aware of any information to indicate that trapping for research purposes (*Factor B*) is a threat to the Southern Cascades DPS currently or in the future. Other potential stressors identified specifically for the Southern Cascades DPS are discussed below.

Wildfire and Fire Suppression

Based on the best scientific and commercial information available, the potential effects of wildfire and fire suppression (*Factor A*) on the Southern Cascades DPS are similar to those described previously for the Sierra Nevada red fox. When they occur, wildfires typically burn in a range of intensities, resulting in a mosaic of habitat effects. Intense, stand-replacing wildfire (similar to the 2011 Dollar Lake fire near Mt. Hood) could reduce habitat availability and quality for this DPS by reducing overstory cover. However, even stand-replacing (high severity) fires do not necessarily result in a complete loss of habitat or occupancy by Sierra Nevada red fox, as demonstrated by the 2014 detections of Sierra Nevada red fox in two locations within the Dollar Lake burn area (McFadden-Hiller and Hiller 2015).

There is uncertainty concerning the potential for population-level effects of wildfire on the Southern Cascades DPS (and we note that the number of Sierra Nevada red fox populations within the range of the DPS is unknown), but it is reasonable to assume that wildfires will continue to occur in the Southern Cascades mountains into the future, potentially at a rate similar to what has been occurring in the recent past. The

most recent wildfires recorded for the Southern Cascades DPS (not necessarily overlapping all of the sighting areas) are: (1) Mt. Hood sighting area—the 2,428 ha (6,000 ac), high-intensity (*i.e.*, removed a significant amount of vegetation) Dollar Lake wildfire in 2011 (NWCC 2015, pp. 1–2); (2) Dutchman Flat sighting area—the 10,570 ha (26,119 ac) Pole Creek burn in 2012 (McFadden-Hiller and Hiller 2015); and (3) Lassen sighting area—the 11,331 ha (28,000 ac) Reading wildfire in 2012.

Land management agencies within the range of the Southern Cascades DPS are expected to continue to implement necessary vegetation or fuels management strategies (*e.g.*, fire management plans, LRMPs) to reduce the likelihood of wide-scale, catastrophic fires. The future effectiveness of these treatments is unknown, but the best available information indicates that at least local reductions in fire severity should be achieved.

Overall, a combination of: (1) The beneficial aspects that wildfires may have for the Sierra Nevada red fox (*e.g.*, habitat changes that promote an increase in suitable prey species and fruiting shrubs that are a supplementary food source); (2) no reports of direct impacts from wildfire to Sierra Nevada red fox; and (3) the broad range that Sierra Nevada red foxes occur across the Southern Cascades (thus preventing a single fire from having significant impacts to a significant portion of the DPS's range), leads us to believe that wildfire (and associated wildfire suppression) is not an overall significant impact to the Southern Cascades DPS. Therefore, we conclude that based on the best scientific and commercial information available, wildfire and fire suppression are not a threat to the Southern Cascades DPS now or into the future.

Climate Change

The similarities in ecology and habitat associations between the Southern Cascades DPS of Sierra Nevada red fox and the rest of the taxon across its entire range, combined with the large scales at which climate change studies are conducted, lead us to conclude that our analysis of the potential effects of climate change (*Factor A*) for the entire taxon similarly applies to the Southern Cascades DPS. The most significant, potential future impact to the Southern Cascades DPS from climate change (likely to manifest itself beyond the 50-year foreseeable future time period) appears to be reduced snowpack levels that would make high-elevation areas more suitable for coyotes, and thus the

fox would shift up in elevation to remain in higher snowpack areas. The DPS could be at an elevated risk at two of the six sighting areas across the DPS's range—the Crater Lake and Lassen sighting areas—because the subspecies currently resides close to the highest elevation possible at those locations. The remaining four sighting areas include suitable habitat at higher elevations than the elevations currently known to be occupied.

Although many climate models generally agree about potential future changes in temperature and a greater proportion of precipitation falling as rain rather than snow, the consequent effects on snowpack levels and vegetation composition are more uncertain, as is the rate at which any such changes might be realized. Therefore, it is not clear how or when changes in snowpack levels, forest type, and plant species composition will affect the distribution of Sierra Nevada red fox habitat within the Southern Cascades DPS. Thus, uncertainty exists regarding the level of impact that climate change may have on Sierra Nevada red fox or their habitat within the Southern Cascades DPS. Overall, we conclude that, based on the best scientific and commercial information available at this time, the expected future (*i.e.*, next 50 years) conditions are not expected to change to a degree that would be considered significant. Thus, based on the best scientific and commercial information available at this time, climate change is not a threat to the Southern Cascades DPS now or into the future.

Trapping or Hunting for Fur

As described earlier in this document, historical unregulated fur trapping (prior to the 1940s) of Sierra Nevada red fox is considered by researchers as the likely cause of the marked contraction in Sierra Nevada red fox's distribution. Until recently, Sierra Nevada red fox in Oregon were considered to be Cascade foxes—of the same subspecies that occupied the Cascades in Washington (Sacks *et al.* 2010, p. 1536). Fur trapping is regulated and remains legal throughout Oregon, although information is not available regarding historical hunting and trapping pressures on Sierra Nevada red foxes in the Oregon Cascades.

Due to regulatory protections, hunting and trapping do not constitute a current or likely future stressor to Sierra Nevada red fox that occur on National Park Service lands at Crater Lake National Park and the entire Lassen sighting area (as discussed above). In the counties where the other four Oregon sighting

areas occur, low numbers of red foxes are harvested, some of which may be Sierra Nevada red fox. The Oregon Department of Fish and Wildlife (ODFW) maintains trapping records by county, without recording exact location or elevation, so harvest of Sierra Nevada red fox in Oregon cannot be distinguished from harvest of lowland fox subspecies (Turner 2015). Records of fox numbers taken from 1989 to 2009 are not separated by year, preventing inferences regarding trends over time. The best available information indicates that numbers of red fox harvested were highest in Lane County (Willamette Pass sighting area) and second highest in Linn County (overlaps part of the Mt. Washington sighting area). The average harvest of red fox has dropped since 1989 across all eight Oregon counties that contain a Sierra Nevada red fox sighting area; however, information is not available to determine whether the harvest decline is due to reduced hunting and trapping effort or reduced numbers of red fox.

In the absence of more definite information regarding the number of Sierra Nevada red fox individuals and populations in Oregon, we do not consider the current harvest levels likely to produce detrimental impact to the DPS, as a whole, across its range. The best available information also does not indicate that the current harvest levels would increase into the future. These activities therefore constitute a stressor that is not impacting the DPS to the degree that the subspecies in the Oregon Cascades is in decline as a consequence of fur trapping. We consider the legal fur trapping within the Oregon Cascades DPS as having no impact to Sierra Nevada red fox at the Crater Lake and Lassen sighting areas, and a low-level impact at the remaining sighting areas in Oregon where relatively few red fox (some of which may be Sierra Nevada red fox) may be harvested. Therefore, because there is no overall significant impact across the DPS's range both currently and into the future, based on the best scientific and commercial information available at this time, trapping or hunting for fur does not rise to the level of a threat.

Disease

We believe that the potential effects of disease (*Factor C*) on the Southern Cascades DPS are the same as those previously described for the entire range of the Sierra Nevada red fox. This conclusion is based on both our understanding of the biology/habits of the subspecies, as well as the presence (or lack thereof) of the various diseases (*i.e.*, SPD, EFF, sarcoptic mange, canine

distemper, and rabies) within the DPS's range. To avoid redundancy, these effects are described in detail above for the entire taxon under *Disease*. Given there is no evidence to suggest that disease has impacted the Southern Cascades DPS population in the past, nor is there evidence to suggest that disease currently affects the DPS or is likely to in the future, we conclude that disease is not a threat to the Southern Cascades DPS now or in the future.

Predation by Domestic Dogs or Coyotes, and Competition With Coyotes

Based on the best scientific and commercial information available, the potential effects of predation by either domestic dogs or coyotes (*Factor C*), as well as competition with coyotes (*Factor E*), on the Sierra Nevada DPS are similar to those described previously for the entire taxon. Given recreational opportunities and regulations, domestic dogs within Sierra Nevada red fox's home range territories within the DPS are most likely to occur in the Willamette Pass, Crater Lake, and Lassen sighting areas, but domestic dogs could also potentially be found along many other roads or recreational areas (e.g., hiking trails) within the DPS's range. To date, predation by a domestic dog has been documented once within the range of the Southern Cascades DPS—one radio-collared Sierra Nevada red fox died in 2000 at the Lassen sighting area. See *Predation by Domestic Dogs or Coyotes*, above, for additional discussion.

Coyotes are known to occur within the Southern Cascades DPS's range, including the following:

(1) Mt. Hood sighting area—One scat was genetically identified in October 2013, at an elevation higher than the Sierra Nevada red fox sightings (i.e., at 1,879 m (6,165 ft) (Akins 2014, p. 2)).

(2) Mt. Washington, Dutchman Flat, and Willamette sighting areas—Four detections occurred in recent years at camera stations in the Willamette and Deschutes National Forests where Sierra Nevada red fox have also been documented to occur (McFadden-Hiller and Hiller 2014, pp. 3, 5–6). The specific locations within the sighting areas were not identified in McFadden-Hiller and Hiller (2014, p. 3).

(3) Lassen sighting area—Perrine's (2005, pp. 73–74) investigations at the Lassen sighting area found coyotes present at all elevations during the summer months. However, coyote population density was found to be greater at lower elevations, thus producing an elevational separation between most coyotes and the Sierra

Nevada red fox population (Perrine 2005, p. 192).

Overall, Sierra Nevada red foxes are better able than coyotes to live in areas of relatively deep snow, thus tending to remain at higher elevations with snowpack where coyotes are less common during winter months. Coyotes are generally found at lower elevations than Sierra Nevada red fox during winter and early spring when snowpack is high (Service 2015, pp. 48–51). Sierra Nevada red fox may potentially benefit from the presence of coyotes—for example, individuals during winter months could benefit by scavenging deer carcasses killed by coyotes (Perrine 2005, p. 31). Additionally, potential future coyote impacts could be lessened if the two recently established wolf packs (which may control coyote numbers but are unlikely to compete or predate upon Sierra Nevada red fox, as wolves tend to take larger game (ODFW 2015, p. 2)) in the Southern Cascades expand.

Similar to those impacts described above for the entire taxon, we do not have information on associated coyote impacts to the Southern Cascades DPS (i.e., no information to indicate that coyotes are causing a decline or that coyotes are increasing in number) either currently nor are they likely to increase into the future. This could change if climate change-related impacts become realized with significantly lowered snowpack levels; alternatively, potential future coyote impacts could be lessened if wolf packs expand within the DPS's range.

Hybridization With Nonnative Red Fox

As described above under the *Hybridization with Nonnative Red Fox* discussion for the entire taxon, hybridization of Sierra Nevada red fox with other nonnative red fox (*Factor E*) could result in outbreeding depression or genetic swamping (Quinn and Sacks 2014, pp. 16–17). The only indication of hybridization within the Southern Cascades DPS is based on genetic testing of mtDNA from two Sierra Nevada red fox individuals at the Mt. Hood sighting area that show evidence of past (not recent) hybridization with nonnative red foxes (Akins and Sacks 2015, p. 1). Although these data indicate that nonnative red fox have bred with the Sierra Nevada red fox at one of the six sighting areas within the DPS's range at some time in the past, the best available data do not indicate current hybridization impacts to any of the sighting areas within the DPS. Therefore, this stressor does not currently rise to the level of a threat. As discussed earlier in this document,

there do not appear to be any geographical barriers separating nonnative red fox from Sierra Nevada red fox, so it is possible that hybridization could take place in other sighting areas in the future. However, we have no information that indicates that hybridization, should it occur, would rise to the level of a threat to the DPS. Therefore, the best available scientific and commercial information available does not suggest that hybridization within the DPS's range is a threat now or in the foreseeable future.

Vehicles

Based on the best scientific and commercial information available, the potential effects of vehicles (i.e., potential road kill and noise disturbance) (*Factor E*) are similar to those described previously for the entire taxon. To date, there are two confirmed reports of Sierra Nevada red fox road kills within the Southern Cascades DPS along Oregon State Highway 20 approximately 80 km (50 mi) west of the Mt. Washington sighting area and two unconfirmed reports near the Crater Lake sighting area. There may also be noise disturbance activity in the portion of the DPS that overlaps with the Willamette Pass Ski Area or the snowparks near the Dutchman Flat sighting area. However, snowmobile-related impacts are largely unknown, and the best available data do not indicate any current or future impacts associated with increases in vehicular activity or noise levels. At this time, information indicates that individual Sierra Nevada red foxes within the range of the Oregon Cascades DPS may be impacted by vehicle activity or noise as opposed to significant impacts across the range of the DPS. Therefore, based on the best scientific and commercial information available at this time, we conclude that vehicles are not a threat to the Oregon Cascades DPS now or in the future.

Small and Isolated Population Effects

Based on the best scientific information available, we believe the potential negative effects associated with small and isolated populations within the Southern Cascades DPS are similar to those presented above for the entire taxon. We recognize that the smaller a population becomes, the more likely it is that one or more stressors could impact a population, potentially reducing its overall size, or resulting in impacts associated with genetic diversity, inbreeding, and reproduction deficiency, all of which can increase a species risk of extinction. Within the Southern Cascades DPS of Sierra Nevada red fox, the number and size of

Sierra Nevada red fox populations in Oregon are not yet known, in large part due the recent discovery that the montane red fox thought to have been the Cascades subspecies were in fact the Sierra Nevada red fox subspecies (see additional discussion for the Sierra Nevada red fox under the *Small and Isolated Population Effects* section, above). Surveys are ongoing at the time of publication of this document. Of the information available for the five Oregon sighting areas, there is no indication that the Oregon populations or sighting areas are being negatively impacted by reduced genetic diversity, inbreeding depression, or reproduction deficiency.

Information is available on the population size of the Lassen sighting area that occurs on the southern end of the DPS's range. Specifically, this population is considered small and represented by 21 breeding and 21 nonbreeding individuals (see Table 1, above). Sacks *et al.* (2010, p. 1536) and Sacks (2015, p. 1) state that the actual size of the Lassen population is likely to be somewhere between 21 and 63 individuals, depending on the number of nonbreeding individuals present. Although suitable habitat is limited between the Lassen and next closest sighting area in the DPS (*i.e.*, Crater Lake), suitable habitat is present, and the best available information suggests that dispersal could potentially occur between sighting areas. We also note that researchers indicate that the Sierra Nevada red fox populations are likely represented by relatively small numbers (Grinnell *et al.* 1937, p. 396) or low population densities (Perrine *et al.* 2010, p. 9).

Given the presence of suitable habitat conditions and the numbers of Sierra Nevada red fox observed to date without comprehensive surveys across the DPS's range, it is reasonable to conclude that additional Sierra Nevada red foxes likely occur throughout the range of the DPS. At this time, despite the relatively geographically disjunct nature of the known sighting areas across the Southern Cascades DPS, there is no evidence to suggest that the sighting areas (and unknown number of populations) are entirely isolated from one another to the degree that we would expect the manifestation of significant negative effects that could potentially arise in small, isolated populations. Additionally, although the Lassen population is considered small at this time, we believe the number of sighting areas and extent of geographic area covered by the subspecies within the DPS contribute to the overall low likelihood of a catastrophic event

potentially impacting the entire DPS's range.

Overall across the Southern Cascades DPS's range at this time, the best available information indicates at least one small population at the southern end of its range, and an unknown number of populations of unknown size throughout the remainder of the DPS's range. Additionally, the best available data do not indicate empirical evidence that the Sierra Nevada red fox is in decline across the DPS. Thus, based on the best scientific and commercial information available at this time, small or isolated population size effects do not rise to the level of a threat within the Southern Cascades DPS either currently or in the future.

Cumulative Effects

The best scientific and commercial information available at this time does not indicate that potential cumulative effects within the Southern Cascades DPS are different than the potential cumulative impacts described above for the entire taxon. Above, we concluded that two cumulative impact scenarios could potentially occur:

(1) Potential increased competition with coyotes on Sierra Nevada red fox as a result of high-elevation forested areas becoming more suitable for coyotes following potential impacts from climate change (*i.e.*, lowered snowpack levels, increased incidence and extent of wildfires).

(2) A combination of potential stressors (*i.e.*, hunting and trapping, SPD and other diseases, competition and predation from coyotes, hybridization with nonnative red fox, and vehicles) that directly result in death or loss of reproductive ability for the Sierra Nevada red fox.

For the purposes of this analysis for the Southern Cascades DPS, and similar to the discussion and conclusion presented above for the entire taxon, the best available data at this time do not suggest that the cumulative effects of potential increased competition from coyotes associated with possible future climate change impacts rise to the level of a threat to the Southern Cascades DPS. Additionally, although it is possible that all or some of the stressors could potentially act in concert as a cumulative threat to the Southern Cascades DPS, the best available data indicate ambiguity in either the likelihood or level of impacts for the various stressors at the DPS-wide level, or the data indicate only individual-level impacts. Thus, data do not indicate that these stressors are cumulatively causing now or will cause in the future a substantial decline of the

Sierra Nevada red fox across the range of the Southern Cascades DPS. Therefore, we have determined that based on the best scientific and commercial information available at this time, the cumulative impacts of these potential stressors do not rise to the level of a threat for the Southern Cascades DPS.

Existing Regulatory Mechanisms—Southern Cascades DPS

Existing regulatory mechanisms that affect the Southern Cascades DPS include laws and regulations promulgated by the Federal Government, State of Oregon government, and State of California government (*Factor D*). These include the following mechanisms that are described in detail in the Species Report (Service 2015, pp. 58–63), and summarized in more detail above under the *Existing Regulatory Mechanisms* section for the entire taxon:

(1) Forest Service policy manual (USDA FS 2005, section 2670.22), which allows for designation of sensitive species of management concern, of which the Sierra Nevada red fox is a sensitive species where it occurs on National Forests in California (U.S. Forest Service Region 5) and in Oregon (USDA 2013, p. 1; Chapman 2015, Excel attch., wksht. 2, line 655).

(2) National Forest management is directed by the Multiple-Use Sustained-Yield Act of 1960, as amended (16 U.S.C. 528 *et seq.*), and the NFMA (16 U.S.C. 1600 *et seq.*). The NFMA specifies that the Forest Service must have an LRMP to guide and set standards for all natural resource management activities on each National Forest, including the Mt. Hood, Willamette, Deschutes, Umpqua, Winema, Rogue River, and Lassen National Forests that currently harbor suitable habitat or known occurrences of Sierra Nevada red fox within the Southern Cascades DPS, and the Forest Service must implement management actions through their LRMPs that provide a conservation benefit to the DPS.

(3) The NWFP (USDA and USDI 1994, entire) guides management over a portion of the Sierra Nevada red fox habitat within the Southern Cascades DPS, specifically to provide the basis for conservation of the northern spotted owl and other late-successional, old-growth forest associated species on Federal lands. The NWFP is important for the DPS because it creates a network of late-successional and old-growth forests that help meet the Sierra Nevada red fox's habitat requirements, discussed above, at the Mt. Hood, Mt.

Washington, Dutchman Flat, and Willamette Pass sighting areas. Several land allocations exist with differing levels of standards and guidelines for managing forest resources, all of which has had an overall positive impact on the forests/resources by substantially reducing habitat loss from forest management activities on Federal lands.

(4) The National Park Service Organic Act of 1916, as amended (16 U.S.C. 1 *et seq.*) and the National Park Service General Authorities Act of 1970 (16 U.S.C. 1a–1) address natural resources on National Park lands, specifically within Crater Lake National Park within the Southern Cascades DPS. These Acts require the National Park Service to “preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities” (USDI NPS 2006, p. 36). Sierra Nevada red fox habitat within park boundaries that are not developed specifically for recreation and camping are managed toward natural processes and species composition, which provides an overall conservation benefit to the subspecies and its habitat.

(5) Although the Sierra Nevada red fox within the Oregon portion of the Southern Cascades DPS may be hunted and trapped (635 Oregon Administrative Rules 050–0045(1), 0045(8)), the best available data do not indicate actual impacts to the Sierra Nevada red fox at this time, nor do the data indicate any impacts to the subspecies into the future.

(6) Within the Lassen sighting area portion of the Southern Cascades DPS, the CESA (CFGC 2050 *et seq.*) prohibits possession, purchase, or “take” of endangered or threatened species without an incidental take permit, issued by CDFW. The Sierra Nevada red fox was designated as a threatened species under CESA in 1980 (CDFW 2014, p. 12). Additionally, the State of California classifies red foxes as a furbearing mammal that is protected from commercial harvest (14 C.C.R. 460).

Overall, existing regulatory mechanisms currently (and into the future) provide substantial protection on Federal lands for the Southern Cascades DPS. Within the Lassen sighting area specifically, the Sierra Nevada red fox’s State-listed status and protection from commercial harvest provide additional, significant protection for the long-term conservation of the subspecies. Although similar protections from hunting and trapping are not available for the remainder of the DPS’s range in Oregon, the best available data do not indicate rangewide impacts to the DPS.

As similarly described above in the *Existing Regulatory Mechanisms* section for the whole taxon, the best available scientific and commercial information indicates that the existing mechanisms are adequate to address impacts to the Southern Cascades DPS from stressors for which governments may have regulatory control (*i.e.*, wildfire, injury or mortality due to fur trapping, and collision with vehicles).

Finding for the Southern Cascades DPS

We assessed the best available scientific and commercial information regarding threats faced by the Southern Cascades DPS. We have reviewed the petition, information available in our files, and information submitted to us following our 90-day finding (77 FR 45; January 3, 2012). We also consulted with Sierra Nevada red fox researchers and Federal land managers. We do not find support for the petitioners’ claim that the Southern Cascades DPS may warrant listing as a federally endangered or threatened species. The petitioners did not outline the threats that they believe are specific to the Southern Cascades DPS, although based on our analysis, we evaluated all stressors identified for the entire taxon across Oregon and California. Our analysis of the best available information indicates that the Southern Cascades DPS is not warranted for listing based on the same reasons identified above for the Sierra Nevada red fox across its entire range. Overall, we found that the stressors that may impact the Southern Cascades DPS are not significantly impacting the subspecies either currently or in the future (such that listing may be warranted). Specifically, we found that five stressors (*i.e.*, wildfire and fire suppression; trapping or hunting for fur; predation by dogs or coyotes, or competition from coyotes; hybridization with nonnative red fox; and vehicles) may impact individuals at one or more sighting areas currently or in the future, but these five stressors are not causing DPS-wide impacts such that the DPS meets the definition of an endangered or threatened species at this time.

Currently, the best available data indicate that the only known population in the Southern Cascades DPS (*i.e.*, the Lassen sighting area) may be experiencing elevated impacts due to its small population size. In addition, both the Lassen and Crater Lake sighting areas may experience (in the future beyond the 50-year time period) combined pressures from coyote predation and competition, as well as climate change-related impacts that could reduce snowpack levels, thereby creating habitat conditions at high

elevations that are more favorable to coyotes. However, the best available data indicate coyotes are not increasing in numbers currently nor are they likely to increase into the future, and thus are not impacting this portion of the DPS’s range to the degree that any more than individuals might be affected both currently and into the future.

Additionally, there is no indication that potential future changes in lowered snowpack levels at high elevations (as suggested by climate models) would occur within the next 50 years to such a degree that coyote numbers would increase throughout the subspecies’ range causing coyote predation or competition to rise to the level of a threat.

In conclusion, and similar to that described above for the Sierra Nevada red fox across its entire range, we believe the Southern Cascades DPS harbors significant suitable habitat throughout its range. These lands are being managed by Federal agencies that are providing management and protections to the DPS and its habitat to benefit the Sierra Nevada red fox. Additionally, the best available data do not indicate any population-level declines from any of the stressors (individually or cumulatively) within any portion of the DPS’s range. Based on our review of the best available scientific and commercial information pertaining to the five factors, we find that the stressors acting upon the Southern Cascades DPS are not of sufficient imminence, intensity, or magnitude to indicate that the DPS is in danger of extinction now (endangered), or likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Significant Portion of the Range—Southern Cascades DPS

Having determined that the Southern Cascades DPS of the Sierra Nevada red fox does not meet the definition of an endangered or threatened species throughout all of its range, we must next consider whether there are any significant portions of the DPS’s range where the DPS is in danger of extinction or is likely to become endangered in the foreseeable future. If we identify any portions that may be both (1) significant and (2) endangered or threatened, we would engage in a more detailed analysis to determine whether these standards are indeed met. Please see the Significant Portion of the Range discussion, above, for the entire taxon for an explanation of relevance of this analysis.

We consider the historical range of the Southern Cascades DPS of Sierra

Nevada red fox to include the mountainous areas from the Columbia River at Mt. Hood south into California, including the area of Mt. Shasta and slightly into the Trinity Mountains, and continuing south to the Lassen Peak area. This range includes those mountainous areas that exceed 1,219 m (4,000 ft) in Oregon (Aubry *et al.* 2015, pp. 1–2; Doerr 2015, pp. 2–3, 13–14, line 7) and 1,200 m (3,937 ft) in California (Perrine *et al.* 2010, p. 8). Based on the best available information at this time, these sighting areas account for the current distribution of the subspecies within the Southern Cascades DPS.

In considering any significant portion of the Southern Cascades DPS, we considered whether the stressors facing the DPS might be different at the six sighting areas where the Sierra Nevada red fox have been found within the Cascades Mountain Range and, thus, geographically concentrated in some portion of the DPS's range. We are unable to find a concentration of stressors in the Lassen area as compared to the remainder of the DPS's range.

Given the extensive coverage of the Southern Cascades DPS compared to the entire range of the subspecies, we believe that the significant portion of the range analysis for this DPS is the same as that presented above for the entire taxon. We are unable to provide any greater level of detail for the Oregon portion of the Southern Cascades DPS range given the limited amount of information available for the Sierra Nevada red fox in Oregon.

In summary, our evaluation of the best available information indicates that the overall level of stressors is not geographically concentrated in one portion of the Southern Cascades DPS range, and the stressors that have the potential to impact the DPS are relatively consistent across its range (Service 2015, entire). Our review of the best available scientific and commercial information indicates that the Southern Cascades DPS of the Sierra Nevada red fox is not in danger of extinction (endangered) nor likely to become endangered within the foreseeable future (threatened), throughout all or a significant portion of its range. Therefore, we find that listing the Southern Cascades DPS of Sierra Nevada red fox as an endangered or threatened species under the Act is not warranted at this time.

Sierra Nevada Distinct Population Segment (DPS) of Sierra Nevada Red Fox

As described above, section 4 of the Act (16 U.S.C. 1533) and implementing

regulations (50 CFR part 424) describe procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a), we may list a species on the basis of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

An endangered species is defined by the Act, with exception, as “any species which is in danger of extinction throughout all or a significant portion of its range.” A threatened species is defined as “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” A species is defined by the Act to include any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.

An analysis of the potential threats for the Sierra Nevada red fox is included in the Species Report (Service 2015, entire) associated with this document (and available at <http://www.regulations.gov> under Docket No. FWS–R8–ES–2011–0103). All potential threats of which we are aware that may act upon the Sierra Nevada DPS of Sierra Nevada red fox (hereafter referred to as Sierra Nevada DPS) currently or in the future are captured within the Summary of Information Pertaining to the Five Factors section, above, and stepped down in the following paragraphs as they pertain specifically to the Sierra Nevada DPS. The range of the Sierra Nevada DPS includes high-elevation (roughly greater than 1,200 m (3,937 ft)) conifer habitat of various types (Perrine *et al.* 2010, p. 8) within the Sierra Nevada mountain range from Sierra to Tulare Counties. However, at this time, Sierra Nevada red fox are only known to reside within the Sonora Pass sighting area.

Similar to the five-factor analysis presented above for the entire taxon, we are not aware of any information to indicate that the following are threats to the Sierra Nevada DPS currently or in the future: Overutilization for commercial, recreational, scientific, or educational purposes, including trapping for fur (*Factor B*); SPD or EFF diseases (*Factor C*); or predation by domestic dogs (*Factor C*). Other potential stressors identified specifically

for the Sierra Nevada DPS are discussed below.

Wildfire and Fire Suppression

Based on the best scientific and commercial information available, the potential effects of wildfire and fire suppression (*Factor A*) on the Sierra Nevada DPS are similar to those described previously for the Sierra Nevada red fox. When they occur, wildfires typically burn in a range of intensities, resulting in a mosaic of habitat effects. Intense, stand-replacing wildfire (similar to the 2013 Rim fire that burned near the Sonora Pass sighting area) could reduce habitat availability and quality for this DPS by reducing overstory cover. Given this DPS currently consists of a single population in the Sonora Pass area, one stand-replacing fire could have significant impacts on this remaining population. However, beneficial aspects of wildfire would also be expected, including improving habitat conditions that promote an increased abundance of preferred prey for the Sierra Nevada red fox. There is uncertainty concerning the potential for population-level effects of wildfire on the Sierra Nevada DPS, but it is reasonable to assume that wildfires will continue to occur in the Sierra Nevada mountains into the future, at least at a rate similar to what has occurred in the recent past. Land management agencies within the range of the Sierra Nevada DPS are also expected to continue to conduct necessary vegetation or fuel management strategies (*e.g.*, fire management plans, LRMPs, SNFPA) to reduce the likelihood of wide-scale, catastrophic fires. The future effectiveness of these treatments is unknown, but the best available information indicates that at least local reductions in fire severity should be achieved. Overall, we conclude that based on the best scientific and commercial information available at this time, wildfire and fire suppression are not a threat to the Sierra Nevada DPS now or into the future.

Climate Change

The similarities in ecology and habitat associations between the Sierra Nevada DPS of Sierra Nevada red fox and the rest of the taxon across its entire range, combined with the large scales at which climate change studies are conducted, lead us to conclude that our analysis of the potential effects of climate change (*Factor A*) for the entire taxon similarly applies to the Sierra Nevada DPS. The most significant, potential future impact to the Sierra Nevada DPS from climate change (likely to manifest itself beyond

the 50-year foreseeable future time period) appears to be reduced snowpack levels that would make high-elevation areas more suitable for coyotes, and thus the fox would shift up in elevation to remain in higher snowpack areas. If the current population does not expand throughout other portions of the Sierra Nevada DPS's range in the future, this impact will likely affect the population, given it currently occurs within a narrow elevational range where the subspecies already occupies the highest elevations in the area.

Although many climate models generally agree about potential future changes in temperature and a greater proportion of precipitation falling as rain rather than snow, the consequent effects on vegetation and snowpack levels are more uncertain, as is the rate at which any such changes might be realized. Therefore, it is not clear how or when changes in snowpack levels, forest type, and plant species composition will affect the distribution of Sierra Nevada red fox habitat within the Sierra Nevada DPS. Thus, uncertainty exists regarding the level of impact that climate change may have on Sierra Nevada red fox or their habitat within the Sierra Nevada DPS. Overall, we conclude that, based on the best scientific and commercial information available at this time, the expected future (*i.e.*, next 50 years) conditions are not expected to change to a degree that would be considered significant. Thus, based on the best scientific and commercial information available at this time, climate change is not a threat to the Sierra Nevada DPS now or into the future.

Disease

As described for the Sierra Nevada red fox subspecies as a whole, numerous pathogens are known to cause severe disease (*Factor C*) in canids. The diseases most likely to affect the Sierra Nevada DPS are sarcoptic mange, canine distemper, and rabies. Although SPD and EFF are diseases that may impact Sierra Nevada red fox in the Southern Cascades DPS (see *Disease* sections, above, for both the taxon as a whole and the Southern Cascades DPS), neither SPD or EFF have been reported within or near the current population at the Sonora Pass sighting area. Additionally, the Sonora Pass sighting area is unlikely to be exposed to these diseases because CDFW does not stock fish from Northern California south of the Feather River (Plumas County) to help prevent transmittal of diseases (including SPD and EFF) (Beale 2011, p. 1).

The best available data indicate that no diseases are affecting the Sierra

Nevada DPS, and given the isolation and low population numbers in this area, transmission of a disease into the population would be less likely, except within family groups (Perrine *et al.* 2010, p. 9). Given there is no evidence to suggest that disease has impacted the Sierra Nevada DPS in the past, nor is there evidence to suggest that disease currently affects the DPS or is likely to in the future, we conclude that disease is not a threat to the Sierra Nevada DPS now or in the future.

Predation and Competition From Coyotes

Based on the best scientific and commercial information available, the potential effects of predation or competition from coyotes (*Factors C and E*) on the Sierra Nevada DPS are similar to those described previously for the entire taxon. Coyotes are present in the Sonora Pass sighting area at the same elevation as Sierra Nevada red fox during the summer months (although the average elevation for coyotes appears to be lower than average elevation for the fox (Quinn and Sacks 2014, pp. 11, 35)), and they appear to outnumber Sierra Nevada red fox in the area (Quinn and Sacks 2014, p. 12). However, Rich (2014, p.1) notes that deep snows in the Sonora Pass sighting area tend to keep coyotes below 2,743 m (9,000 ft).

At this time, the best available information indicates the presence of coyotes within the range of the Sierra Nevada DPS, but we do not have information to indicate associated impacts to the Sierra Nevada red fox (*i.e.*, no information to indicate that coyotes are causing a decline or that coyotes are increasing in number such that they constitute a threat to the DPS) either currently or in the future. This could change if climate change-related impacts become realized with significantly lowered snowpack levels; alternatively, a potential future coyote impact could be lessened if wolf packs continue to expand outside of Oregon and into the Sierra Nevada mountain range. Restoration of wolves in California in sustainable populations would likely lower coyote population numbers or exclude them from higher elevation forested areas, thereby facilitating the persistence of Sierra Nevada red fox populations (Levi and Wilmers 2012, p. 926); wolves are unlikely to compete heavily with Sierra Nevada red fox because they tend to take larger game (ODFW 2015, p. 8).

Hybridization With Nonnative Red Fox

Hybridization can result in outbreeding depression or genetic

swamping (Quinn and Sacks 2014, pp. 16–17; Sacks *et al.* 2015, p. 2). Hybridization is a recently described impact within the Sierra Nevada DPS. In a study conducted from October 2011 through September 2014, researchers documented interbreeding between female Sierra Nevada red fox and two male nonnative red foxes in 2013, resulting in 10 hybrid pups (Quinn and Sacks 2014, pp. 2, 10). This interbreeding was followed by documented inbreeding (breeding between related foxes) between the nonnative male and one of his hybrid female offspring resulting in an additional backcross hybrid pup in 2014 (Quinn and Sacks 2014, pp. 16, 30). This breeding of native Sierra Nevada red fox with nonnative red foxes is the only indication of successful reproduction in the study area during the last 3 years (Quinn and Sacks 2014, pp. 9–10); this study covered 20 to 50 percent of the high-quality habitat present in the Sonora Pass sighting area. The two nonnative male adults that entered the Sierra Nevada DPS and bred with Sierra Nevada red fox individuals were not closely related, but both showed a combination of fur-farm stock and Rocky Mountain red fox ancestry and likely originated from a population somewhere in the Great Basin of Nevada (Quinn and Sacks 2014, p. 16). Additionally, a third nonnative male of unknown origin was detected at the Sonora Pass sighting area in 2014, but it is not known to have bred (Sacks *et al.* 2015, pp. 16, 22).

Overall, this documented hybridization is likely resulting in a reduction in reproduction of native Sierra Nevada red fox within the DPS. Sacks *et al.* (2015, p. 14) report reduced genetic diversity in the Sierra Nevada red fox at Sonora Pass; specifically, genetic diversity has declined to two-thirds of its historical estimate in this area. In addition, Sacks *et al.* (2015, p. 3) state that lack of breeding among native individuals in the Sierra Nevada DPS over recent years is potentially indicative of inbreeding depression. Overall, inbreeding depression and the potential for outbreeding depression and genomic replacement from the nonnatives represent issues of concern for the Sonora Pass population (Sacks *et al.* 2015, p. 3). We have no information to indicate that nonnative red fox will cease inhabiting and interbreeding with Sierra Nevada red fox within the Sierra Nevada DPS into the future. Therefore, based on the best scientific and commercial information available at this time, we conclude that hybridization with nonnative foxes is a threat to the

Sierra Nevada DPS (currently represented by a single population in the Sonora Pass sighting area) both currently and into the future.

Vehicles

Based on the best scientific and commercial information available, the potential effects of vehicles (*i.e.*, road kill and noise disturbance) (*Factor E*) are similar to those described previously for the entire taxon. To date, there has been a single report of a Sierra Nevada red fox road kill within the Sierra Nevada DPS (prior to 2010 along California State Highway 395), and there may be noise disturbance activity in the portion of the DPS that overlaps with the Bridgeport Winter Recreation Area within the Humboldt-Toiyabe National Forest or the Marine's Corps' Marine Warfare Training Center (MWTC). However, snowmobile-related impacts are largely unknown, as demonstrated by the Forest Service's current investigation in accordance with Standard 32 of the SNFPA, results of which are not yet available. Additionally, no known impacts to Sierra Nevada red fox have been reported at the MWTC. At this time, information indicates that individual Sierra Nevada red fox within the range of the Sierra Nevada DPS may be impacted by vehicle activity or noise as opposed to significant impacts across the range of the DPS. Therefore, based on the best scientific and commercial information available at this time, we conclude that vehicles are not a threat to the Sierra Nevada DPS now or in the future.

Small Population Effects

The best available genetic data for the taxon are indicative of a decline in the Sierra Nevada DPS over time. Regarding genetic diversity and the small population of the Sierra Nevada DPS, current heterozygosity levels in nuclear DNA (*i.e.*, a measure of genetic diversity) are considerably lower (average = 0.44) than heterozygosity levels historically (0.64), thus indicating a recent negative trend in population size (Quinn and Sacks 2014, pp. 13–14). Reductions in the diversity of mtDNA since historical times also indicate a recent decline in population numbers (Quinn and Sacks 2014, p. 14). Consistent with reductions in genetic diversity, there has also been recent documented inbreeding in this population. As described in the *Hybridization With Nonnative Red Fox* section, above, two nonnative male red fox are documented to have entered the population, bred with native individuals, and produced a minimum of 11 hybrid pups between 2012 and

2014 (Sacks *et al.* 2015, pp. 3, 16, 30). During that same time, no surviving native pups were successfully produced in the study area. Only two adult native males were known from the area, and one of those was apparently either killed or driven off by one of the incoming nonnative males. A third nonnative male was documented in the study area in 2014, but did not successfully interbreed (Sacks *et al.* 2015, p. 16).

Overall, the best available scientific and commercial information suggests a single, extant population of Sierra Nevada red fox currently exists in the Sierra Nevada DPS, and the population is small, declining, and isolated. There has been no indication of native fox reproduction since 2011. Therefore, based on the best scientific and commercial information available at this time, we conclude the negative effects of reduced genetic diversity and reproduction deficiency are a threat to the Sierra Nevada DPS currently and into the future. In addition, these negative effects are associated with isolation and can also be influenced by hybridization. At this point in time, however, we do not have information to determine how hybridization will influence genetic diversity and reproduction.

Cumulative Effects

We are not aware of any information to indicate that potential cumulative effects within the Sierra Nevada DPS are different than the potential cumulative impacts described above for the entire taxon and for the Southern Cascades DPS. Above, we concluded that two cumulative impact scenarios could potentially occur:

(1) Potential increased competition with and predation from coyotes on Sierra Nevada red fox as a result of high-elevation forested areas becoming more suitable for coyotes following potential impacts from climate change (*i.e.*, lowered snowpack levels, increased incidence and extent of wildfires).

(2) A combination of potential stressors (*i.e.*, hunting and trapping, disease, competition and predation from coyotes, hybridization with nonnative red fox, and vehicles) that directly result in death or loss of reproductive ability for the Sierra Nevada red fox.

To avoid redundancy, these effects are described in detail above for the entire taxon and the Southern Cascades DPS under *Cumulative Effects*. Similar to those discussions above, the best available data at this time do not suggest that the cumulative effects of increased coyote numbers and climate change rise to the level of a threat to the Sierra

Nevada DPS overall. Additionally, the best available data indicate ambiguity in either the likelihood or level of impacts for the various stressors at the DPS-wide level, or the data indicate only individual-level impacts. Thus, data do not indicate that these stressors are cumulatively causing now or will cause in the future a substantial decline of the Sierra Nevada red fox across the range of the Sierra Nevada DPS. Therefore, based on the best scientific and commercial information available at this time, we have determined that the cumulative impacts of these potential stressors do not rise to the level of a threat for the Sierra Nevada DPS.

Existing Regulatory Mechanisms— Sierra Nevada DPS

Existing regulatory mechanisms that affect the Sierra Nevada DPS include laws and regulations promulgated by the Federal Government and State of California governments (*Factor D*). These include the following mechanisms that are described in detail in the Species Report (Service 2015, pp. 58–63) and summarized in more detail above under the *Existing Regulatory Mechanisms* section for the entire taxon:

(1) Forest Service policy manual (USDA FS 2005, section 2670.22), which allows for designation of sensitive species of management concern, of which the Sierra Nevada red fox is a sensitive species where it occurs on National Forests in California (U.S. Forest Service Region 5).

(2) National Forest management is directed by the Multiple-Use Sustained-Yield Act of 1960, as amended (16 U.S.C. 528 *et seq.*), and the NFMA (16 U.S.C. 1600 *et seq.*). The NFMA specifies that the Forest Service must have an LRMP to guide and set standards for all natural resource management activities on each National Forest, including the Humboldt-Toiyabe and Stanislaus National Forests that currently harbor suitable habitat or known occurrences of Sierra Nevada red fox within the Sierra Nevada DPS. In addition, the Forest Service must implement management actions through their LRMPs that provide a conservation benefit to the DPS.

(3) The SNFPA requires fire and fuels management projects in most areas to retain at least 40 percent (preferably 50 percent) canopy cover within a treatment unit and effectively requires retention of trees 63.5 cm (25 in) dbh in most treated areas (USDA 2004, pp. 3, 50), which is close to the preferred winter habitat characteristics likely preferred by the subspecies. Additionally, SNFPA requires the Forest Service to: (a) Conduct an analysis to

determine whether activities within 8 km (5 mi) of a verified Sierra Nevada red fox sighting have the potential to affect the species (USDA 2004, p. 54), (b) mandate a limited operating period of January 1 to June 30 as necessary to avoid adverse impacts to potential breeding, and (c) require 2 years of evaluations for activities near sightings that are not associated with a den site.

(4) The OPLMA (Pub. L. 111–11, p. 1059) established the Bridgeport Winter Recreation Area to control winter vehicles on Forest Service land, consisting of about 2,833 ha (7,000 ac) in the northern portion of the Sonora Pass sighting area (USDA 2010, p. 4). The OPLMA states that the winter use of snowmobiles is allowed in the Recreation Area, but is subject to terms and conditions, which can minimize potential impacts to sensitive resources. The Forest Service has completed a management plan that calls for monitoring of impacts to wildlife (USDA 2010, p. 9) and is proceeding with evaluations of impacts to Sierra Nevada red fox (see *Vehicles*, above).

(5) The National Park Service Organic Act of 1916, as amended (16 U.S.C. 1 *et seq.*) and the National Park Service General Authorities Act of 1970 (16 U.S.C. 1a–1) address natural resources on National Park lands, specifically within Yosemite National Park within the Sierra Nevada DPS. These Acts require the National Park Service to “preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities” (USDI NPS 2006, p. 36). Yosemite National Park’s land management plan (USDI NPS 1980, pp. 10–11) does not contain specific measures to protect the Sierra Nevada red fox or its habitat, but does characterize the portion of the Park in the Sonora Pass sighting area as a “wilderness subzone,” wherein “natural systems and processes will be permitted to follow their minimum intrusion by man.”

(6) The CESA (CFGC 2050 *et seq.*) prohibits possession, purchase, or “take” of endangered or threatened species without an incidental take permit issued by CDFW. The Sierra Nevada red fox was designated as a threatened species under CESA in 1980 (CDFW 2014, p. 12). In addition, the State of California classifies red foxes as a furbearing mammal that is protected from commercial harvest (14 C.C.R. 460).

Additionally, we note that the U.S. Marine Corps’ MWTC has lands within a portion of the Sonora Pass sighting area. The U.S. Marine Corps has initiated preparation of an INRMP

(Norquist 2014, p. 2) consistent with requirements outlined in the Sikes Act (16 U.S.C. 670a), which would address potential impacts to natural resources, presumably to include the Sierra Nevada red fox. Because an INRMP is not yet finalized, we cannot evaluate its adequacy as a regulatory mechanism.

Overall, existing regulatory mechanisms currently (and into the future) provide substantial protection on Federal lands for the Sierra Nevada DPS. Within the Sonora Pass sighting area specifically, the Sierra Nevada red fox’s State-listed status and protection from commercial harvest provide additional significant protection for the long-term conservation of the subspecies. As similarly described above in the *Existing Regulatory Mechanisms* section for the whole taxon, the best available scientific and commercial information indicates that the existing mechanisms are adequate to address impacts to the Sierra Nevada DPS from stressors for which governments may have regulatory control (*i.e.*, wildfire, injury or mortality due to harvest, and injury or mortality due to collision with vehicles).

Finding for the Sierra Nevada DPS

We assessed the best available scientific and commercial information regarding threats faced by the Sierra Nevada DPS. We have reviewed the petition, information available in our files, and information submitted to us following our 90-day finding (77 FR 45; January 3, 2012). We also consulted with Sierra Nevada red fox researchers and Federal land managers. We find support for the petitioners’ claim that the Sierra Nevada DPS may warrant listing as a federally endangered or threatened species. Although the petitioners did not outline the threats that they believe are specific to the Sierra Nevada DPS, we have identified threats from hybridization with nonnative red fox and negative effects of reduced genetic diversity, inbreeding (breeding between related foxes), and reproduction deficiency as the significant factors for this DPS. Overall, we believe the Sierra Nevada DPS is warranted for listing based on the following information:

(1) *Range contraction*—The Sierra Nevada red fox has experienced a range contraction of greater than 90 percent from its historical range (based on our visual comparison of the historical range (Grinnell *et al.* 1937, p. 382; Perrine *et al.* 2010, p. 4) to the current extent of the Sonora Pass sighting area) within the Sierra Nevada mountain range. We note a reduction of Sierra Nevada red fox observations based on:

- 1920s to the 1940s/1950s: Reduced harvest of pelts recorded within California.

- 1940s to 1980: Increasingly rare sightings in California that led to the State prohibition on red fox trapping in 1974, and the State listing of the subspecies as a threatened species in 1980 (Statham *et al.* 2012, p. 123).

- 1996 to 2002: Extensive carnivore surveys throughout the Sierra Nevada (Zielinski *et al.*, 2005, entire); no Sierra Nevada red fox were observed.

- 2010: Discovery of Sierra Nevada red fox at what is described herein as the Sonora Pass sighting area.

- 2011 to 2015: Occupancy information from a study near Sonora Pass (Quinn and Sacks 2014, entire; Sacks *et al.* 2015, entire) and from additional camera stations in Yosemite National Park maintained by the National Park Service. This best available and most recent information indicates a single population in the Sonora Pass sighting area as opposed to its much more extensive historically occupied area within the Sierra Nevada mountain range. The Sonora Pass sighting area extends along the crest of the Sierra Nevada Mountains from north of State Route 108 south into Yosemite National Park (Sacks *et al.* 2015, pp. 10–11), overlapping Tuolumne, Mono, and Alpine Counties, and including a recent sighting documented at the north end of Yosemite National Park during 2015 (Lindelof 2015, pp. 1–2).

(2) *Declining population and inbreeding depression*—Comparisons of historical and current population estimates indicate that the Sierra Nevada DPS, as currently represented solely by the Sonora Pass population, is in decline (Sacks *et al.* 2010, p. 1532; Sacks *et al.* 2015, p. 14). The Sierra Nevada red fox within the Sierra Nevada DPS is comprised of an estimated 14 breeding individuals, with a total adult population size estimate of 10 to 50 (Quinn and Sacks 2014, pp. 3, 10, 11, 14; Sacks *et al.* 2015, p. 14). Repeated resampling of individuals over the 3-year study period (October 2011 through September 2014) suggests that most adults with territories overlapping the study area were found (Quinn and Sacks 2014, p. 14).

The low population size estimate for the single extant population known within the Sierra Nevada DPS is supported by analyses of genetic diversity (Quinn and Sacks 2014, pp. 13–14). For instance, the current average heterozygosity (a measure of genetic diversity) in nuclear DNA for Sierra Nevada red fox at the Sonora Pass sighting area (0.44) is considerably lower than heterozygosity levels present

historically (0.64), indicating a relatively recent negative trend in population size (Quinn and Sacks 2014, pp. 13–14). Reductions in the diversity of mtDNA since historical times also indicate a decline in population numbers (Quinn and Sacks 2014, p. 14).

Associated with a known small population is the high apparent isolation of the Sonora Pass population, which has likely resulted in inbreeding depression. The Sonora Pass population is approximately 250 km (155 mi) from the nearest population to the north (Lassen sighting area), with no known Sierra Nevada red fox populations to the south. Genetic testing also shows a lack of migration between the Lassen and Sonora Pass populations (Statham *et al.* 2012, p. 129) (see *Discreteness* discussion, above).

We recognize that the Sierra Nevada red fox, in general across its entire range, has likely always been a relatively rare species. Grinnell *et al.* (1937, p. 396) described Sierra Nevada red fox population numbers as “relatively small, even in the most favorable territory,” and reported that the subspecies likely occurred at densities of 1 per 2.6 square km (1 per square mi). Perrine *et al.* (2010, p. 9) concluded that, based on this information, Sierra Nevada red fox likely occur at low population densities even within areas of high relative abundance. The most recent information for the Sierra Nevada DPS indicates a small current population that is likely the remnant of a much larger population and likely a remnant of multiple populations within the DPS’s range.

(3) *Hybridization with nonnative red fox*—The arrival and documented breeding of nonnative red fox into the Sierra Nevada DPS, as documented between 2011 and 2014 (Quinn and Sacks 2014, pp. 2, 10) will bring alleles that are otherwise rare or missing from the population, which in turn may help alleviate inbreeding depression. However, continued breeding of nonnative red fox with the native Sierra Nevada DPS could lead to outbreeding depression, genetic swamping, and potentially the eventual extirpation of the Sierra Nevada DPS. The recent study documented interbreeding between female Sierra Nevada red fox and two male nonnative red foxes, resulting in seven hybrid pups in 2013, and another four hybrid pups in 2014 (Sacks *et al.* 2015, pp. 3, 15–17, 30). One of the four hybrids produced in 2014 resulted from the pairing of a nonnative male and one of his hybrid female offspring (Sacks *et al.* 2015, pp. 15–17, 30). The pup was thus 75 percent nonnative.

(4) *No evidence of recent “native” Sierra Nevada red fox reproduction*—The 11 nonnative hybridized pups produced (as described above) are the only clear indication of successful reproduction in the study area (Sacks *et al.* 2015, pp. 3, 10–11) between 2011 and 2014, which covered between 20 and 50 percent of the contiguous high-quality habitat present in the Sonora Pass sighting area. Although unknown, it is possible that Sierra Nevada red fox could have reproduced in portions of the sighting area not covered by the 3-year study.

In summary, we find that the significant threats to the Sierra Nevada DPS both currently and into the future are hybridization with nonnative red fox and the negative effects of reduced genetic diversity, inbreeding, and reproduction deficiency. These threats appear to be having significant impacts on the single remaining population in the DPS at Sonora Pass. These impacts are evident from the best available scientific and commercial information that shows a combination of range contraction of greater than 90 percent from its historical range, an apparent declining population, inbreeding depression, hybridization, and no clear indication of successful native Sierra Nevada red fox reproduction since at least 2011. These stressors cumulatively impact the DPS.

On the basis of the best scientific and commercial information available, we find that the petitioned action to list the Sierra Nevada DPS of the Sierra Nevada red fox is warranted. We will make a determination on the status of the DPS as endangered or threatened when we develop a proposed listing determination. However, as explained in more detail below, an immediate proposal of a regulation implementing this action is precluded by higher priority listing actions, and progress is being made to add or remove qualified species from the Lists of Endangered and Threatened Wildlife and Plants.

We reviewed the available information to determine if the existing and foreseeable threats render the Sierra Nevada DPS of Sierra Nevada red fox at risk of extinction now such that issuing an emergency regulation temporarily listing the species under section 4(b)(7) of the Act is warranted. We determined that issuing an emergency regulation temporarily listing the DPS is not warranted for the DPS at this time because the threats facing the DPS are not of an imminent nature that necessitate emergency listing, and the best available scientific and commercial information do not indicate that the Sonora Pass population is at imminent

risk of extinction. However, if at any time we determine that issuing an emergency regulation temporarily listing the Sierra Nevada DPS of the Sierra Nevada red fox is warranted, we will initiate the action at that time.

Listing Priority Number—Sierra Nevada DPS

The Service adopted guidelines on September 21, 1983 (48 FR 43098) to establish a rational system for utilizing available resources for the highest priority species when adding species to the Lists of Endangered or Threatened Wildlife and Plants (Lists). These guidelines, titled “Endangered and Threatened Species Listing and Recovery Priority Guidelines,” address the immediacy and magnitude of threats, and the level of taxonomic distinctiveness by assigning priority in descending order to monotypic genera (genus with one species), full species, and subspecies (or equivalently, distinct population segments of vertebrates). We assigned the Sierra Nevada DPS of the Sierra Nevada red fox a listing priority number (LPN) of 3 based on our finding that the DPS faces threats that are of high magnitude and are imminent. These threats include impacts associated with small population size (*e.g.*, inbreeding depression, insufficient reproduction) and hybridization with nonnative red fox. This is the highest priority that can be provided to a DPS of a subspecies under our guidance. Our rationale for assigning the Sierra Nevada DPS an LPN of 3 is outlined below.

Under the Service’s LPN Guidance, the magnitude of threat is the first criterion we look at when establishing a listing priority. The guidance indicates that “species” (defined by the Act to include biological subspecies and distinct vertebrate population segments) with the highest magnitude of threat are those species facing the greatest threats to their continued existence. These species receive the highest listing priority.

The threats that the Sierra Nevada DPS of Sierra Nevada red fox are high in magnitude because the major threats (hybridization with nonnative red fox and inbreeding depression and insufficient reproduction associated with small population size) occur throughout the range of the Sierra Nevada DPS. The severity of the effects of these threats and the rapidity with which they have caused impacts is high given that a minimum of 11 hybrid pups have been produced since 2013 in a population with an overall population size of fewer than 50 individuals. In addition, during 2013 and 2014, no successful fully native reproduction was

documented (only hybrid reproduction was documented), suggesting that hybridization is negatively affecting native Sierra Nevada red fox reproduction within the Sierra Nevada DPS. The Sonora Pass population is the only known remaining representative of the Sierra Nevada DPS; thus, threats to the population constitute threats to the DPS as a whole, and loss of the population would constitute permanent loss of the DPS as a whole. There also is no information to indicate that any ongoing conservation efforts are likely to reduce the severity of these threats into the foreseeable future.

Under our LPN guidance, the second criterion we consider in assigning a listing priority is the immediacy of threats. This criterion is intended to ensure that the species that face actual, identifiable threats are given priority over those for which threats are only potential or that are intrinsically vulnerable but are not known to be presently facing such threats. We consider the threats facing the Sierra Nevada DPS to be imminent because we have factual information that the threats are identifiable and that the Sierra Nevada DPS is currently facing them throughout its range. These actual, identifiable threats are covered in detail under the discussion of Factors within this finding for the Sierra Nevada DPS, and currently include hybridization with nonnative red fox, and inbreeding depression and insufficient reproduction associated with small population size. In addition to their current existence, we expect these threats to continue and likely intensify in the foreseeable future as there is no information to indicate that any ongoing conservation efforts are occurring or likely to reduce the imminence of these threats into the future. Because these threats are currently occurring, they are imminent.

The third criterion in our LPN guidance is intended to devote resources to those species representing highly distinctive or isolated gene pools as reflected by taxonomy. The Sierra Nevada DPS is an entity that receives a lower priority than would a species as a whole, particularly if the species were the only one in its genus. The Sierra Nevada DPS of the Sierra Nevada red fox faces high-magnitude and imminent threats, and is a valid taxon at the subspecies (and DPS) level. Thus, in accordance with our LPN guidance, we have assigned the Sierra Nevada DPS an LPN of 3.

We will continue to monitor the threats to the Sierra Nevada DPS, and the DPS's status on an annual basis, and should the magnitude or the imminence

of the threats change, we will revisit our assessment of the LPN.

Work on a proposed listing determination for the Sierra Nevada DPS is precluded by work on higher priority listing actions with absolute statutory, court-ordered, or court-approved deadlines and final listing determinations for those species that were proposed for listing with funds from Fiscal Years 2014 and 2015. This work includes all the actions listed in the tables below under expeditious progress.

Preclusion and Expeditious Progress

To make a finding that a particular action is warranted-but-precluded, the Service must make two findings: (1) That the immediate proposal and timely promulgation of a final regulation is precluded by pending listing proposals, and (2) that expeditious progress is being made to add qualified species to either of the Lists and to remove species from the Lists (16 U.S.C. 1533(b)(3)(B)(iii)).

Preclusion

A listing proposal is precluded if the Service does not have sufficient resources available to complete the proposal, because there are competing demands for those resources, and the relative priority of those competing demands is higher. Thus, in any given fiscal year (FY), multiple factors dictate whether it will be possible to undertake work on a listing proposal regulation or whether promulgation of such a proposal is precluded by higher priority listing actions—(1) The amount of resources available for completing the listing function, (2) the estimated cost of completing the proposed listing, and (3) the Service's workload and prioritization of the proposed listing in relation to other actions.

Available Resources

The resources available for listing actions are determined through the annual Congressional appropriations process. In FY 1998 and for each fiscal year since then, Congress has placed a statutory cap on funds that may be expended for the Listing Program. This spending cap was designed to prevent the listing function from depleting funds needed for other functions under the Act (for example, recovery functions, such as removing species from the Lists), or for other Service programs (see House Report 105–163, 105th Congress, 1st Session, July 1, 1997). The funds within the spending cap are available to support work involving the following listing actions: Proposed and final listing rules; 90-day

and 12-month findings on petitions to add species to the Lists or to change the status of a species from threatened to endangered; annual “resubmitted” petition findings on prior warranted-but-precluded petition findings as required under section 4(b)(3)(C)(i) of the Act; critical habitat petition findings; proposed and final rules designating critical habitat; and litigation-related, administrative, and program-management functions (including preparing and allocating budgets, responding to Congressional and public inquiries, and conducting public outreach regarding listing and critical habitat).

We cannot spend more for the Listing Program than the amount of funds within the spending cap without violating the Anti-Deficiency Act (see 31 U.S.C. 1341(a)(1)(A)). In addition, since FY 2002, the Service's budget has included a critical habitat subcap to ensure that some funds are available for completing Listing Program actions other than critical habitat designations (“The critical habitat designation subcap will ensure that some funding is available to address other listing activities” (House Report No. 107–103, 107th Congress, 1st Session, June 19, 2001)). In FY 2002 and each year until FY 2006, the Service had to use virtually the entire critical habitat subcap to address court-mandated designations of critical habitat, and consequently none of the critical habitat subcap funds were available for other listing activities. In some FYs since 2006, we have been able to use some of the critical habitat subcap funds to fund proposed listing determinations for high-priority candidate species. In other FYs, while we were unable to use any of the critical habitat subcap funds to fund proposed listing determinations, we did use some of this money to fund the critical habitat portion of some proposed listing determinations so that the proposed listing determination and proposed critical habitat designation could be combined into one rule, thereby being more efficient in our work. In FY 2014, based on the Service's workload, we were able to use some of the critical habitat subcap funds to fund proposed listing determinations.

For FY 2012, Congress also put in place two additional subcaps within the listing cap: One for listing actions for foreign species and one for petition findings. As with the critical habitat subcap, if the Service does not need to use all of the funds within the subcap, we are able to use the remaining funds for completing proposed or final listing determinations. To date, in FY 2015, based on the Service's workload, we

have not yet determined if we are able to use some of the funds within the foreign species subcap and the petitions subcap to fund proposed listing determinations.

We make our determinations of preclusion on a nationwide basis to ensure that the species most in need of listing will be addressed first and also because we allocate our listing budget on a nationwide basis. Through the listing cap, the three subcaps, and the amount of funds needed to complete court-mandated actions within those subcaps, Congress and the courts have in effect determined the amount of money available for other listing activities nationwide. Therefore, the funds in the listing cap—other than those within the subcaps needed to comply with court orders or court-approved settlement agreements requiring critical habitat actions for already-listed species, listing actions for foreign species, and petition findings—set the framework within which we make our determinations of preclusion and expeditious progress.

For FY 2015, on December 16, 2014, Congress passed a Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113–235), which provides funding through September 30, 2015, at the same level as FY 2014. In particular, it includes an overall spending cap of \$20,515,000 for the listing program. Of that, no more than \$1,504,000 can be used for listing actions for foreign species, and no more than \$1,501,000 can be used to make 90-day or 12-month findings on petitions. The Service thus has \$12,905,000 available to work on proposed and final listing determinations for domestic species. In addition, if the Service has funding available within the critical habitat, foreign species, or petition subcaps after those workloads had been completed, it can use those funds to work on listing actions other than critical habitat designations or foreign species.

Costs of Listing Actions. The work involved in preparing various listing documents can be extensive, and may include, but is not limited to: Gathering and assessing the best scientific and commercial data available and conducting analyses used as the basis for our decisions; writing and publishing documents; and obtaining, reviewing, and evaluating public comments and peer review comments on proposed rules and incorporating relevant information into final rules. The number of listing actions that we can undertake in a given year also is influenced by the complexity of those listing actions; that is, more complex actions generally are more costly. The

median cost for preparing and publishing a 90-day finding is \$39,276; for a 12-month finding, \$100,690; for a proposed rule with critical habitat, \$345,000; and for a final listing rule with critical habitat, \$305,000.

Prioritizing Listing Actions. The Service's Listing Program workload is broadly composed of four types of actions, which the Service prioritizes as follows: (1) Compliance with court orders and court-approved settlement agreements requiring that petition findings or listing or critical habitat determinations be completed by a specific date; (2) section 4 (of the Act) listing and critical habitat actions with absolute statutory deadlines; (3) essential litigation-related, administrative, and listing program-management functions; and (4) section 4 listing actions that do not have absolute statutory deadlines. In FY 2010, the Service received many new petitions and a single petition to list 404 species, significantly increasing the number of actions within the second category of our workload—actions that have absolute statutory deadlines. As a result of the petitions to list hundreds of species, we currently have over 460 12-month petition findings yet to be initiated and completed.

To prioritize within each of the four types of actions, we developed guidelines for assigning a listing priority number (LPN) for each candidate species (48 FR 43098, September 21, 1983). Under these guidelines, we assign each candidate an LPN of 1 to 12, depending on the magnitude of threats (high or moderate to low), immediacy of threats (imminent or nonimminent), and taxonomic status of the species (in order of priority: Monotypic genus (a species that is the sole member of a genus); species; or part of a species (subspecies or distinct population segment)). The lower the listing priority number, the higher the listing priority (that is, a species with an LPN of 1 would have the highest listing priority). A species with a higher LPN would generally be precluded from listing by species with lower LPNs, unless work on a proposed rule for the species with the higher LPN can be combined with work on a proposed rule for other high-priority species. This is not the case for Sierra Nevada DPS of the Sierra Nevada red fox. Thus, in addition to being precluded by the lack of available resources, the Sierra Nevada DPS of the Sierra Nevada red fox with an LPN of 3, is also precluded by work on proposed listing determinations for those candidate species with a higher listing priority.

Finally, proposed rules for reclassification of threatened species to endangered species are lower priority, because as listed species, they are already afforded the protections of the Act and implementing regulations. However, for efficiency reasons, we may choose to work on a proposed rule to reclassify a species to endangered if we can combine this with work that is subject to a court-determined deadline.

Since before Congress first established the spending cap for the Listing Program in 1998, the Listing Program workload has required considerably more resources than the amount of funds Congress has allowed for the Listing Program. It is therefore important that we be as efficient as possible in our listing process. Therefore, as we implement our listing work plan and work on proposed rules for the highest priority species in the next several years, we are preparing multi-species proposals when appropriate, and these may include species with lower priority if they overlap geographically or have the same threats as one of the highest priority species. In addition, we take into consideration the availability of staff resources when we determine which high-priority species will receive funding to minimize the amount of time and resources required to complete each listing action.

Listing Program Workload. Each FY we determine, based on the amount of funding Congress has made available within the Listing Program spending cap, specifically which actions we will have the resources to work on in that FY. We then prepare Allocation Tables that identify the actions that we are funding for that FY, and how much we estimate it will cost to complete each action; these Allocation Tables are part of our record for this notice and the listing program. Our Allocation Table for FY 2012, which incorporated the Service's approach to prioritizing its workload, was adopted as part of a settlement agreement in a case before the U.S. District Court for the District of Columbia (Endangered Species Act Section 4 Deadline Litigation, No. 10–377 (EGS), MDL Docket No. 2165 (“MDL Litigation”), Document 31–1 (D. D.C. May 10, 2011) (“MDL Settlement Agreement”). The requirements of paragraphs 1 through 7 of that settlement agreement, combined with the work plan attached to the agreement as Exhibit B, reflected the Service's Allocation Tables for FY 2011 and FY 2012. In addition, paragraphs 2 through 7 of the agreement require the Service to take numerous other actions through FY 2017—in particular, complete either a proposed listing rule or a not-

warranted finding for all 251 species designated as “candidates” in the 2010 candidate notice of review (“CNOR”) before the end of FY 2016, and complete final listing determinations within one year of proposing to list any of those species. Paragraph 10 of that settlement agreement sets forth the Service’s conclusion that “fulfilling the commitments set forth in this Agreement, along with other commitments required by court orders or court-approved settlement agreements already in existence at the signing of this Settlement Agreement (listed in Exhibit A), will require substantially all of the resources in the Listing Program.” As part of the same lawsuit, the court also approved a separate settlement agreement with the other plaintiff in the case; that settlement agreement requires the Service to complete additional actions in specific fiscal years—including 12-month petition findings for 11 species, 90-day petition findings for 477 species, and proposed listing determinations or not-warranted findings for 39 species.

These settlement agreements have led to a number of results that affect our preclusion analysis. First, the Service has been, and will continue to be, limited in the extent to which it can undertake additional actions within the Listing Program through FY 2017, beyond what is required by the MDL settlement agreements. Second, because the settlement is court approved, two broad categories of actions now fall within the Service’s highest priority (compliance with a court order): (1) The Service’s entire prioritized workload for FY 2012, as reflected in its Allocation Table; and (2) completion, before the end of FY 2016, of proposed listings or not-warranted findings for those candidate species that were included in the 2010 CNOR where we have not already published a not-warranted finding or proposed rule. Therefore, each year, one of the Service’s highest priorities is to make steady progress towards completing by the end of 2017 proposed and final listing determinations for the 2010 candidate species—based on its LPN prioritization system, preparing multi-species actions when appropriate, and taking into

consideration the availability of staff resources.

The Sierra Nevada DPS of the Sierra Nevada red fox was not listed as a candidate in the 2010 CNOR, nor was the proposed listing for the Sierra Nevada DPS of the Sierra Nevada red fox included in the Allocation Tables that were reflected in the MDL settlement agreement. As we have discussed above, we have assigned an LPN of 3 to the Sierra Nevada DPS of the Sierra Nevada red fox. Therefore, even if the Service has some additional funding after completing all of the work required by court orders and court-approved settlement agreements, we would first fund actions with absolute statutory deadlines for species that have lower LPNs. In light of all of these factors, funding a proposed listing for the Sierra Nevada DPS of the Sierra Nevada red fox is precluded by court-ordered and court-approved settlement agreements, listing actions with absolute statutory deadlines, and work on proposed listing determinations for those candidate species with a lower LPN.

Expeditious Progress

As explained above, a determination that listing is warranted but precluded must also demonstrate that expeditious progress is being made to add and remove qualified species to and from the Lists. As with our “precluded” finding, the evaluation of whether progress in adding qualified species to the Lists has been expeditious is a function of the resources available for listing and the competing demands for those funds. (Although we do not discuss it in detail here, we are also making expeditious progress in removing species from the list under the Recovery program in light of the resources available for delisting, which is funded by a separate line item in the budget of the Endangered Species Program. Thus far, during FY 2015, we delisted the Oregon chub due to recovery (80 FR 9126–9150). As discussed below, given the limited resources available for listing, we find that we are making expeditious progress in FY 2015 in the Listing Program.

We provide below tables cataloguing the work of the Service’s Listing Program in FY 2015. This work includes all three of the steps necessary for adding species to the Lists: (1) Identifying species that warrant listing; (2) undertaking the evaluation of the best available scientific information about those species and the threats they face, and preparing proposed and final listing rules; and (3) adding species to the Lists by publishing proposed and final listing rules that include a summary of the data on which the rule is based and show the relationship of that data to the rule. After taking into consideration the limited resources available for listing, the competing demands for those funds, and the completed work catalogued in the tables below, we find that we are making expeditious progress to add qualified species to the Lists FY 2015.

In addition to the work the Service has completed towards adding qualified species to the Lists, on May 10, 2011, the Service filed in the MDL litigation a settlement agreement that incorporated the Service’s work plan for FY 2012; the court approved that settlement agreement on September 9, 2011. Paragraph 10 of that settlement agreement provides, “The Parties agree that the timetables for resolving the status of candidate species outlined in this Agreement constitute expeditious progress in adding qualified species to the lists of threatened and endangered species.” The Service also filed a second settlement agreement that required even more work in FY 2012. The Service had already begun in FY 2011 to implement that work required by the work plan, and many of these initial actions in our work plan include work on proposed rules for candidate species with an LPN of 2 or 3. Therefore, both by entering into the first settlement agreement and by completing the listing actions required by both settlement agreements, the Service is making expeditious progress to add qualified species to the lists. As provided for in the settlement agreements and the work plan incorporated into the first agreement, the Service’s progress in FY 2015 include completing and publishing the following determinations:

FY 2015 COMPLETED LISTING ACTIONS

Publication date	Title	Actions	FR Pages
10/24/2014	Threatened Species Status for Dakota Skipper and Endangered Species Status for Poweshiek Skipperling.	Final Listing Endangered and Threatened	79 FR 6367–63748
11/20/2014	Threatened Species Status for Gunnison sage-grouse.	Final Listing Threatened	79 FR 69191–69310

FY 2015 COMPLETED LISTING ACTIONS—Continued

Publication date	Title	Actions	FR Pages
12/11/2014	Threatened Species Status for the Rufa Red Knot.	Final Listing Threatened	79 FR 73705–73748
12/31/2014	90-day finding on Monarch Butterfly and California Gnatcatcher.	90-day petition finding Substantial	79 FR 78775–78778
4/2/2015	Threatened Species Status for the Northern Long-eared Bat with 4(d) Rule.	Final Listing Threatened	80 FR 17973–18033
4/7/2015	Endangered Species Status for the Big Sandy Crayfish and the Guyandotte River Crayfish.	12-month petition finding Warranted Proposed Listing Endangered.	80 FR 18710–18739
4/7/2015	12-Month Finding on a Petition To List Humboldt Marten as an Endangered or Threatened Species.	12-month petition finding Not warranted	80 FR 18742–18772
4/10/2015	90-Day Findings on Ten Petitions (Clear Lake hitch, Mojave shoulderband snail, Northern spotted owl, Relict dace, San Joaquin Valley giant flower-loving fly, Western pond turtle, Yellow-cedar, Egyptian tortoise, Golden conure, Long-tailed chinchilla).	90-day petition finding Substantial	80 FR 19259–19263
4/23/2015	Withdrawal of the Proposed Rule To List the Bi-State Distinct Population Segment of Greater Sage-Grouse and Designate Critical Habitat.	Proposed Rule Withdrawal	80 FR 22828–22866
6/23/2015	12-Month Finding on a Petition to List Leona’s Little Blue Butterfly as Endangered or Threatened.	12-month petition finding Not warranted	80 FR 35916–35931
6/30/2015	90-day Petition Findings on 31 Species	90-day petition finding Substantial and not substantial (not substantial for Gray Wolf, Blue Ridge gray-cheeked salamander, California giant salamander, Caddo Mountain salamander, Colorado checkered whiptail, the DPS of Wild Horse, Olympic torrent salamander, Pigeon Mountain salamander, Weller’s salamander and wingtail crayfish; substantial for alligator snapping turtle, Apalachicola kingsnake, Arizona toad, Blanding’s turtle, Cascade Caverns salamander, Cascades frog, Cedar Key mole skink, foothill yellow-legged frog, gopher frog, green salamander, Illinois chorus frog, Kern Canyon slender salamander, Key ringneck snake, Oregon slender salamander, Relictual slender salamander, Rim Rock crowned snake, Rio Grande cooter, silvery phacelia, spotted turtle, southern hog-nosed snake, and western spadefoot toad).	80 FR 37568–37579
9/15/2015	12-Month Finding on a Petition to List the New England Cottontail as an Endangered or Threatened Species.	12-month petition finding Not warranted Notice Candidate removal.	80 FR 55286–55304
9/15/2015	Threatened Species Status for <i>Platanthera integrilabia</i> (White Fringeless Orchid).	Proposed Listing Threatened	80 FR 55304–55321
9/18/2015	90-Day Findings on 25 Petitions	90-day petition finding Substantial and not substantial (not substantial for Cahaba pebblesnail and the Stephens’ kangaroo rat; substantial for Blue Calamintha bee, California spotted owl, Cascade torrent salamander, Columbia torrent salamander, Florida pine snake, Inyo Mountains salamander, Kern Plateau salamander, lesser slender salamander, limestone salamander, northern bog lemming, Panamint alligator lizard, Peaks of Otter salamander, rusty-patched bumblebee, Shasta salamander, short-tailed snake, southern rubber boa, regal fritillary, Tinian monarch, tricolored blackbird, tufted puffin, Virgin River spinedace, wood turtle, and the Yuman desert fringe-toed lizard).	80 FR 56423–56432

FY 2015 COMPLETED LISTING ACTIONS—Continued

Publication date	Title	Actions	FR Pages
9/29/2015	Endangered Species Status for <i>Chamaecrista lineata</i> var. <i>keyensis</i> (Big Pine Partridge Pea), <i>Chamaesyce deltoidea</i> ssp. <i>serpyllum</i> (Wedge Spurge), and <i>Linum arenicola</i> (Sand Flax), and Threatened Species Status for <i>Argythamnia blodgettii</i> (Blodgett's Silverbush).	Proposed Listing Endangered and Threatened.	80 FR 58535–58567
9/30/15	Endangered Status for 49 Species from the Hawaiian Islands.	Proposed Listing Endangered	80 FR 58820–58909
9/30/15	Threatened Species Status for Elfin-woods warbler.	Proposed listing Threatened	80 FR 58674–58688
9/30/15	Threatened Species Status for Eastern massasauga rattlesnake.	Proposed listing Threatened	80 FR 58688–58701

Our expeditious progress also included work on listing actions that we funded in previous fiscal years, and in FY 2015, but have not yet been completed to date. For these species, we have completed the first step, and have

been working on the second step, necessary for adding species to the Lists. Some of these actions have been submitted to the **Federal Register**; however, they have not yet published in the **Federal Register**. These actions are

listed below. Actions in the table are being conducted under a deadline set by a court through a court order or settlement agreement.

FY15 ACTIONS SUBMITTED TO THE FEDERAL REGISTER BUT NOT YET PUBLISHED

Species	Action
12-Month Finding on a Petition to List Greater Sage-grouse (<i>Centrocercus urophasianus</i>) as an Endangered or Threatened Species.	12-month petition finding Not warranted Notice Candidate removal.
Endangered Species Status for <i>Chamaecrista lineata</i> var. <i>keyensis</i> (Big Pine Partridge Pea), <i>Chamaesyce deltoidea</i> ssp. <i>serpyllum</i> (Wedge Spurge), and <i>Linum arenicola</i> (Sand Flax), and Threatened Species Status for <i>Argythamnia blodgettii</i> (Blodgett's Silverbush).	Proposed Listing Endangered and Threatened.
Endangered Status for 16 Species and Threatened Status for 7 Species in Guam and the Commonwealth of the Northern Mariana Islands.	Final Listing Endangered and Threatened.
Columbia spotted frog—Great Basin DPS	12-month petition finding Not warranted Notice Candidate removal.
Sequatchie caddisfly	12-month petition finding Not warranted Notice Candidate removal.
Four florida plants (Florida pineland crabgrass, Florida prairie clover, pineland sandmat, and Everglades bully).	Proposed listing.
Kentucky arrow darter	Proposed listing.
Cumberland arrow darter	12-month petition finding Not warranted Notice Candidate removal.
6 Cave beetles (Noblelets, Baker Station, Fowler's, Indian Grave Point, inquirer, and Coleman).	12-month petition finding Not warranted Notice Candidate removal.
Headwater chub	Proposed listing.
Roundtail chub DPS	Proposed listing.
Page springsnail	12-month petition finding Not warranted Notice Candidate removal.
Sonoran desert tortoise	12-month petition finding Not warranted Notice Candidate removal.
Goose Creek milkvetch	12-month petition finding Not warranted Notice Candidate removal.
Sleeping Ute milkvetch	12-month petition finding Not warranted Notice Candidate removal
Suwannee moccasinshell	12-month petition finding.
American eel	12-month petition finding Not warranted.

ACTIONS FUNDED IN PREVIOUS FYs AND FY 2015 BUT NOT YET COMPLETED

Species	Action
Actions Subject to Court Order/Settlement Agreement	
Washington ground squirrel	Proposed listing.
Xantus's murrelet	Proposed listing.
Black warrior waterdog	Proposed listing.
Black mudalia	Proposed listing.
Highlands tiger beetle	Proposed listing.
Sicklefin redhorse	Proposed listing.
Texas hornshell	Proposed listing.
Guadalupe fescue	Proposed listing.

ACTIONS FUNDED IN PREVIOUS FYs AND FY 2015 BUT NOT YET COMPLETED—Continued

Species	Action
Actions Subject to Statutory Deadline	
Miami Tiger Beetle	90-day petition finding.

Another way that we have been expeditious in making progress to add qualified species to the Lists is that we have endeavored to make our listing actions as efficient and timely as possible, given the requirements of the relevant law and regulations, and constraints relating to workload and personnel. We are continually considering ways to streamline processes or achieve economies of scale, such as by batching related actions together. Given our limited budget for implementing section 4 of the Act, these efforts also contribute towards finding that we are making expeditious progress to add qualified species to the Lists.

The Sierra Nevada DPS of the Sierra Nevada red fox will be added to the list of candidate species upon publication of this 12-month finding. We will continue to monitor the status of this DPS as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

We intend that any proposed listing action for the Sierra Nevada DPS of the Sierra Nevada red fox will be as accurate as possible. Therefore, we will continue to accept additional information and comments from all concerned governmental agencies, the scientific community, industry, or any other interested party concerning this finding.

We request that you submit any new information concerning the status of, or threats to, the Sierra Nevada DPS, the Southern Cascades DPS, or the Sierra Nevada red fox (in general) to our Sacramento Fish and Wildlife Office (see **ADDRESSES**) whenever it becomes available. New information will help us monitor Sierra Nevada red fox throughout the subspecies' range, and encourage its conservation. If an emergency situation develops for the Sierra Nevada DPS, Southern Cascades DPS, or the subspecies in general, we will act to provide immediate protection.

References Cited

A complete list of references cited is available on the Internet at <http://www.regulations.gov> and upon request from the Sacramento Fish and Wildlife Office (see **ADDRESSES**).

Authors

The primary authors of this document are the staff members of the Pacific Southwest Regional Office.

Authority

The authority for this section is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: September 29, 2015.

Signed:

James W. Kurth,

Acting Director, U.S. Fish and Wildlife Service.

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