22. FISHER

Today's Item **Information** ☐ **Action** ☒

Consider whether to add fisher to the list of threatened or endangered species and, if FGC determines that listing may be warranted, authorize publication of a notice of its intent to amend Section 670.5, Title 14, CCR.

Summary of Previous/Future Actions

• Received petition	Apr 10, 2008; Bodega Bay
• Findings that listing is not warranted	Sep 10, 2010; McClellan
• Decision to set aside Sep 2010 decision	Nov 7, 2012; Los Angeles
• Received DFW's status review	Jun 10-11, 2015; Mammoth Lakes
• **Today's action to determine if listing is warranted**	**Aug 4-5, 2015; Fortuna**
• Adopt findings	To be determined
• Amend regulations if listing warranted	To be determined

Background

In 2008 the Center for Biological Diversity (CBD) petitioned FGC to list Pacific fisher (*Martes pennant*), now known as fisher (*Pekania pennanti*) as threatened or endangered under the California Endangered Species Act (CESA). In 2010 FGC determined that listing was not warranted and CBD filed suit in court to overturn FGC's decision. At its Nov 2012, meeting in Los Angeles, FGC met in executive session and, pursuant to court order, voted to set aside its 2010 findings rejecting the petition; FGC also requested that DFW prepare a status review for FGC's consideration.

The status review represents DFW's final written review of the status of the fisher and is based upon the best scientific information available to DFW. Because fishers occur in California in two geographically separate areas, with demonstrated distinct genetic differentiation, DFW treated the two geographic areas as two separate evolutionarily significant units (ESUs): the Northern California ESU and the Southern Sierra Nevada ESU. The status review contains DFW's recommendation that listing as a threatened species in the Northern California ESU is ***not*** warranted, but listing as a threatened species in the Southern Sierra Nevada ESU ***is*** warranted.

Significant Public Comments

1. The Environmental Protection Information Center (EPIC) identifies concerns with DFW's status review and urges FGC to list both ESU populations as threatened under CESA (Exhibit 3).
2. Chad Hanson, Ph.D. with the John Muir Projectsupports listing both ESUs and provides additional information about fishers, wildland fire, and the effects of pre- and post-fire management on fisher populations (Exhibit 5)
3. CBD and Melissa Miller support the petition (exhibits 6 and 7).

4. Sierra Pacific Industries urges FGC not to list fisher and to encourage and support future translocation efforts (Exhibit 4).
5. Calforests and Green Diamond Resource Company oppose listing fisher and request that previously submitted data and comments be included in the record for the Aug hearing (exhibits 8 and 9).

Recommendation

FGC staff: Supports DFW's recommendation.

DFW: DFW recommends that listing the fisher as a threatened species in the Southern Sierra Nevada ESU is warranted, but listing the fisher as a threatened species in the Northern California ESU is not warranted.

Exhibits

1. Petition from the Center for Biological Diversity to list Pacific fisher
2. DFW memo and status review
3. Epic comments on DFW's status review, received Jul 17, 2015
4. Letter from Sierra Pacific Industries, received on Jul 23, 2015
5. Letter from The John Muir Project, received on Jul 23, 2015
6. Letter from Center for Biological Diversity, received on Jul 23, 2015
7. Email from Melissa Miller, received Jul 18, 2015
8. Letter from Calforests, received Jul 23, 2015
9. Letter from Green Diamond Resource Company, received Jul 23, 2015

Motion/Direction

1. Close record

Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5(d), closes the administrative record and public comment period for this agenda item.

AND

2. List fisher as threatened in the south, do not list in the north, and authorize notice

Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds the information contained in the petition to list the fisher, and the other information in the record before the Commission warrants listing the fisher as a threatened species in the Southern Sierra Nevada ESU, but does not warrant listing the fisher as a threatened species in the Northern California ESU under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

AND

Moved by _____ and seconded by _____ that the Commission authorizes publication of its intent to amend Section 670.5, Title 14, CCR, to add the fisher in the Southern Sierra Nevada ESU to the list of animals of California declared to be threatened.

OR

3. List fisher as threatened in the south and the north, and authorize notice

Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds the information contained in the petition to list the fisher, and the other information in the record before the Commission warrants listing the fisher as a threatened species in the Southern Sierra Nevada ESU and the Northern California ESU under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

AND

Moved by _____ and seconded by _____ that the Commission authorizes publication of its intent to amend Section 670.5, Title 14, CCR, to add the fisher in the Southern Sierra Nevada ESU and the Northern California ESU to the list of animals of California declared to be threatened.

OR

4. Do not list fisher as threatened

Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2075.5 of the Fish and Game Code, finds that the information contained in the petition and other information before the Commission does not warrant listing the fisher as a threatened species under the California Endangered Species Act. (Note: Findings will be adopted at a future meeting.)

Pacific Biodiversity Institute

A Petition to list the Pacific fisher (*Martes pennanti*) as an Endangered or Threatened Species under the California Endangered Species Act

Center for Biological Diversity

January 2008

CENTER *for* BIOLOGICAL DIVERSITY

Because life is good.

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EXECUTIVE SUMMARY

"*Once [the fisher is restored], we will be an important step closer to returning our forests to ecological wholeness. As one biologist points out, 'Top-level carnivores tend to have a big influence on ecosystems. Without the fisher, that role is missing from West Coast forests.' "*

Tim McNulty; Excerpted from the November 2001 issue of Forest Magazine

The Center for Biological Diversity submits this petition to list the California population of the Pacific fisher (*Martes pennanti*) as an endangered or threatened species under the California Endangered Species Act, Fish and Game Code 2070 *et seq*. ("CESA"). This petition demonstrates that the Pacific fisher has been extirpated throughout more than half its former range in California, is in serious danger of becoming extinct in the state, and warrants immediate listing under CESA.

Oregon Department of Fish and Wildlife

The fisher is a specialized forest carnivore related to weasels and otters that is associated with mature and old-growth forests. Historic trapping for the animal's valuable pelt, timber harvest, loss of an important prey item (porcupine), urban development, and other factors have severely reduced the fisher's range across the United States. In the eastern United States, the fisher recovered much of its range after strict trapping regulations, regrowth of forest from abandoned farmlands, and reintroductions. In the western United States, however, the genetically 'distinct population segment' (hereafter referred to as the "Pacific fisher") has not re-inhabited the majority of its former range, despite the cessation of legal trapping in the 1930s and 1940s. The Pacific fisher is apparently extinct in the state of Washington, and is reduced to just three small, isolated populations in southern Oregon and California. **The Pacific fisher now occupies less than half the range it occupied in California 75 years ago**.

The Pacific fisher in the United States is reduced to one small reintroduced population in southern Oregon near Crater Lake, and two small, isolated, native populations in California: one in northwestern California-southwestern Oregon (in the North Coast Range and Klamath region) numbering at most 750 animals, and another in the southern Sierra Nevada numbering at most 360 individuals. **Thus, the maximum population estimate for Pacific fishers within the entire state of California is no more than 1,110 animals**. Moreover, the two remnant populations are separated by approximately 430 kilometers, which greatly exceeds the maximum dispersal distance ever recorded for a fisher, rendering genetic exchange between the two native populations virtually impossible. Finally, due to the extinction of the Pacific fisher from Washington and most of Oregon, the three small populations in California and southern Oregon are themselves completely isolated from populations in British Columbia.

Reestablishing the Pacific fisher in a larger portion of its range is necessary to ensure its long-term survival, provided that suitable habitat is conserved and restored. However, **both of California's fisher populations are threatened by continued logging, development, roads, and other anthropogenic factors, as well as low genetic diversity, population isolation, and demographic stochasticity**. Scientists have been warning of the Pacific fisher's perilous population decline and impending extinction in California for more than a decade, yet existing regulatory mechanisms remain grossly inadequate to protect the species and its habitat: the Sierra Nevada Framework, the Northwest Forest Plan, and the California State Forest Practices Code all fail to prevent continued loss and degradation of mature and old-growth forests on public and private lands. In 2000, in response to a petition submitted by the Center for Biological Diversity and others, the U.S. Fish and Wildlife Service determined that the Pacific fisher warranted listing under the federal Endangered Species Act: the distinct population segment is designated as a candidate species. Unfortunately, candidate status under the federal Endangered Species Act offers no legal protection. Survival and recovery of this highly imperiled, ecologically important, top-level carnivore in California is unlikely to happen without protection provided by CESA. Thus, we are petitioning to list the Pacific fisher as an endangered or threatened species throughout its historic California range.

STATUTORY FRAMEWORK AND REQUESTED ACTION

Three petitions were submitted to list the fisher in the western United States under the federal Endangered Species Act, 16 U.S.C. § 1531 *et seq*. (Beckwitt 1990, Carlton 1994, Greenwald et al. 2000). Beckwitt (1990) petitioned to list the fisher as endangered within the West Coast Range, but as the subspecies *Martes pennanti pacifica*. The U.S. Fish and Wildlife Service (USFWS) determined that there was insufficient information to indicate *pacifica* is a valid subspecies, but did recognize the West Coast Range as a "distinct population segment" (90-day finding on a petition to list the Pacific fisher as endangered, Federal Register January 11, 1991). They rejected the petition, however, because of lack of information, which was limited to only one study on habitat use in the western United States and little information on current distribution.

Carlton (1994) petitioned to list the fisher in the entire western United States as endangered. This petition was ultimately rejected because the USFWS claimed the petitioner had failed to provide evidence indicating that the two remaining populations (Pacific States and northern Rocky Mountains) were distinct population segments listable under the Act (90-day finding for a petition to list the fisher in the western United States as threatened, Federal Register March 1, 1996). The finding, however, acknowledged that "available information indicates fishers have experienced declines in the past, and may be vulnerable to the removal and fragmentation of mature/old-growth habitat and incidental trapping pressure."

Greenwald et al. (2000) petitioned to list the West Coast population segment of fisher as endangered. USFWS determined that a listing of the West Coast population segment of the fisher was "warranted but precluded by other, higher priority listing actions" (12-month finding for a petition to list west coast distinct population segment of the fisher; Proposed Rule, Federal Register April 8, 2004). The finding acknowledged that "because of small population sizes and isolation, fisher populations on the West Coast may be in danger of extirpation" and that "existing regulatory mechanisms are not sufficient to protect the [distinct population segment] as a whole from habitat pressures."

Since these petitions were filed, more information on fisher habitat use, current distribution and status, and ongoing loss of habitat has become available and is incorporated into this CESA petition. CESA is modeled after the federal ESA, and is intended to provide an additional layer of protection for imperiled species in California. The CESA may be more protective than the federal ESA. CESA § 2072.3 states:

> "[t]o be accepted, a petition shall, at a minimum, include sufficient scientific information that a petitioned action may be warranted. Petitions shall include information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and any other factors that the petitioner deems relevant."

The available scientific data, including recent distribution maps, population estimates, and specific habitat requirements as well as immediate and future threats and lack of adequate regulations that are outlined in this petition, demonstrate unequivocally that the Pacific fisher has experienced a significant diminution of habitat and range in the state of California, and is vulnerable extinction.

ECOLOGY OF THE FISHER

I. Species Description

The fisher is a member of the weasel family (Mustelidae). The fisher has a long slender body with short legs and a long, bushy tail; a triangular head with a sharp, pronounced muzzle; forward-facing eyes; and large, rounded ears (Powell and Zielinski 1994). Sexual dimorphism is pronounced, with males weighing between 3.5 and 5.5 kg and ranging in length from 90 to 120 cm, and females weighing between 2.0 and 2.5 kg and ranging from 75 to 95 cm long (Powell 1993). Fishers are mostly dark brown in color. Their face, neck, and shoulders are silver or light brown, contrasting with the guard hairs on the tail, legs, and rump, which are glossy black (Powell and Zielinski 1994). Their undersurface is uniformly brown, except for white or cream colored patches around the genitals and on the chest, which may be individually distinctive (Powell 1993). The fur ranges in length from 30 mm on the stomach and chest to 70 mm on the back (Powell 1993). Fishers molt once a year beginning in late summer and finishing by November or December – in September and October the guard hairs are noticeably shorter than during the rest of the year (Powell and Zielinski 1994). Fishers have five toes with retractable but not sheathed claws. Their feet are large and plantigrade with four central pads and a pad on each toe. On the hindpaws, the central pads have circular patches of coarse hair that are associated with plantar glands. These glands produce a distinctive odor and are believed to be used for communication during reproduction (Powell 1993). Based on an examination of several skins, Grinnell et al. (1937) noted that fishers from the Sierra Nevada had a "tendency" to be paler in color than fishers from other parts of the United States.

II. Taxonomy and Genetics

A member of the family Mustelidae, the fisher is the largest member of the genus *Martes*, which includes the yellow-throated martens, true martens, and fishers. Formerly included in the *Mustela*, the *Martes* are distinguished from this group by an additional premolar in each jaw, among other things (see Anderson 1994). *Martes pennanti* (Erxleben) is the only extant species of the fisher. Goldman (1935) recognized three subspecies: *Martes pennanti pennanti* (eastern and central North America), *Martes pennanti columbiana* (Rocky Mountains), and *Martes pennanti pacifica* (West Coast North America). Conversely, both Grinnell et al. (1937) and Hagmeir (1959) examined specimens from across the range of the fisher without finding sufficient differences in morphology or pelage to support recognition of separate subspecies.

Recent genetic analyses found patterns of population subdivision similar to the earlier described subspecies (Drew et al. 2003). This observed variation was considered by Drew et al. to be insufficient to warrant recognition of subspecies, but sufficient to support recognition of distinct population segments. The West Coast population of the fisher was also recognized as a distinct population segment by USDI (1991, 2004). The present document recognizes the fisher in its West Coast range as a distinct population segment, hereafter denoted as the Pacific fisher, but refers to it as *Martes pennanti*.

Paleonological evidence suggests that forests along the Pacific Coast were colonized by fishers during the Holocene era (Wisely et al. 2004). Wisely et al. (2004) hypothesized that fishers colonized the Sierra Nevada in a 'stepping-stone' manner from north to south over the last 5,000 years, with very little gene flow among populations after colonization. Recently, fishers have been extirpated in the northern Sierra Nevada, most of Oregon, and all of Washington. The authors document a progressive loss of genetic diversity along the north-south gradient, with allelic richness of the southern Sierra Nevada at the lowest levels of all populations in theirs and previous studies of fisher. High levels of genetic differentiation and population isolation were confirmed by the exceptionally low effective numbers of migrants between populations. Even two southern Sierra populations separated by <100 km of contiguous forest but divided by the Kings River, were estimated to exchange, on average, only one migrant every 50 generations (Wisely et al. 2004).

III. Diet

Fishers are opportunistic, generalist predators with a diverse diet, including birds, porcupines (*Erethizon dorsatum*), snowshoe hares (*Lepus americana*), squirrels (*Sciurus* spp., *Tamiasciurus* spp., *Glaucomys* spp.), mice and voles (*Clethrionomys gapperi*, *Microtus* spp., *Peromyscus* spp.), shrews (*Blarina* spp., *Sorex* spp.), insects, carrion of deer (*Odocoileus* spp.) and moose (*Alces alces*), vegetation, and fruit (Powell 1993, Martin 1994, Powell and Zielinski 1994, Zielinski et al. 1999, Weir et al. 2005, Bowman et al. 2006). Pacific fishers in the southern Sierra Nevada and northern California utilize substantially different prey than fishers in other parts of the country (Zielinski et al. 1999). The diet of fishers in the southern Sierra Nevada is characterized by taxonomic diversity and importance of smaller prey species relative to elsewhere in its range (Zielinski et al. 1999). Throughout most of its range, snowshoe hare and porcupine are important components of the fisher's diet (Bowman et al. 2006). The southern Sierra Nevada, however, is not within the range of the snowshoe hare and the porcupine currently occurs only at very low densities (Zielinski et al. 1999). Both prey items are present in the Klamath-North Coast region, though not abundant, but Golightly et al. (2006) reported that fisher there did not extensively use porcupines or members of the Leporidae family. Although mammals were still the most frequent prey found in fisher scat from the southern Sierra, reptiles, especially the alligator lizard *Elgaria*, constituted a major prey item, occurring in 20.4 percent of all observed scat and 37.7 percent of scat collected in spring (Zielinski et al. 1999). Similarly, reptiles were found to be an important prey item for fishers in Northern California (24.5 percent frequency of occurrence in scat; Golightly et al. 2006), particularly in the interior regions, but elsewhere in North America they constitute a very minor portion of the fisher's diet (<1 percent) (Zielinski et al. 1999). Also unique to the southern Sierra Nevada and northern California, fishers were found to potentially feed on hypogeous fungi (false truffles) (Grenfell and Fasenfest 1979, Zielinski et al. 1999). Commenting on the unique diet of the fisher in the Sierra Nevada, Zielinski et al. (1999) conclude:

> "As a reputed habitat specialist, it may be adaptive for fishers to consider many of the other species with which they occur as potential foods. Perhaps this is the reason that fishers are capable of finding, capturing, and eating so many of the species that occur in, or near, late-seral conifer forests in the Sierra Nevada."

Zielinski et al. (1999) found slight variation in diet with season. Mammals, in particular deer carrion, were consumed most in winter, presumably when other prey were hibernating. Predictably, fruit were eaten more commonly in autumn and winter when they are typically available. No differences were found in diet between males and females, despite significant sexual dimorphism.

Zielinski and Duncan (2004) postulated that the wide range of relatively small prey items in the diet of Pacific fishers in the southern Sierra Nevada may be explained by either the low occurrence of relatively large prey such as lagomorphs and porcupines, or by the high diversity of food items available in the region compared with other boreal forests where fishers previously have been studied. No studies are available correlating reproductive and survival rates with size and species of prey items consumed. This information may be important because the elimination of the porcupine – a large prey species favored by the fisher in Canada and the eastern U.S. – from much of the range of the fisher in California may have had an impact on fisher demography.

IV. Hunting Behavior

Studies of fisher foraging behavior are limited to the eastern United States (Raine 1987, Arthur and Krohn 1991, Powell 1993). It is unknown to what extent these studies can be generalized to the Pacific fisher in California, where different prey species are available. Based on observations of fisher tracks in the winter, Powell (1993) determined that fishers in Michigan travel in straight lines to patches of high prey density and then forage in a "zig zag" pattern, changing direction frequently. These changes in direction are not random, as fishers appear to purposefully investigate potential prey hiding places, such as hollow logs, piles of forest litter, or root-balls (Raine 1987, Powell 1993). This behavior was most often exhibited by fishers when hunting snowshoe hares, but also when hunting other small mammals (Powell 1993). Fishers rarely chase prey for long distances, instead prey are caught directly after they are flushed. Fishers do not pounce on small mammals with their paws like canids. Prey is killed with a bite to the back of the neck or head. When killing hares, fishers sometimes wrap their body around them and hold on with their

back legs (Powell 1993). Fishers often cache food. When feeding on deer carcasses, fishers often will find a resting den nearby and repeatedly return to the carcass to feed.

Although fishers will dig holes in the snow to find prey, they exhibit far less subnivean activity than their close relative the American marten (Raine 1987). Fishers are known to occasionally forage in trees (Raine 1987, Powell 1993). Fishers are active both in the day and night with peak activity occurring near sunset and sunrise (Arthur and Krohn 1991, Powell 1993). Activity periods typically last from two to five hours (Powell 1993). Fishers hunt exclusively in forested habitats and generally avoid openings. Deep, light snow and thin crusts restrict the movements of the fishers, and the animals will hunt in habitats in which they can travel most easily rather than habitats that have the most prey (Raine 1987). Thus, the distribution of deep snow may limit distribution of fisher, and might result in decreased reproductive success as well as decreased success of reintroduction efforts (Powell and Zielinski 1994).

V. Reproduction and Growth

The breeding season for the fisher begins in late February and lasts until mid-April, although some births occur as late as May (Frost et al. 1997). The testes of males begin to enlarge in early March and most males are producing sperm by mid-March (Powell 1993, Frost et al. 1997). Females come into estrus in early April three to nine days after parturition. Except during the breeding season, fishers are solitary animals. Beginning in March, males are more active and roam beyond the limits of their territories in search of females (Arthur and Krohn 1991, Powell 1993). As males cross territories, there is sometimes intra-specific aggression with several researchers noting scars that they believed resulted from conflict with other male fishers (Leonard 1986, Powell 1993). Mate searching is likely assisted by marking of elevated objects, such as rocks and stumps, with urine, feces and musk, by both sexes (Leonard 1986, Powell 1993). Fishers are likely polygamous and may be polyandrous (Powell 1993). Courtship is often prolonged, lasting anywhere from one to seven hours, and involves tail flagging, chasing, and vocalization, mostly on the part of the female (Powell 1993). If the female is not receptive, she will be aggressive towards the male. Ovulation may be stimulated by copulation (Frost et al. 1997).

Gestation period ranged from 338 to 358 days in captive fishers, but implantation of the blastocyst is delayed approximately nine months (Frost et al. 1997) and may correlate with increasing photoperiod (Powell 1993). During that time, embryonic development is arrested (Frost et al. 1997). Following implantation, the blastocyst resumes growing for around 40 days until birth (Frost et al. 1997). Parturition thus occurs nearly one year later and just prior to mating. Arthur and Krohn (1991) and Powell (1993) speculate that this system allows adults to breed in a time when it is energetically efficient, while still giving kits adequate time to develop before winter. Raised entirely by the female, kits are altricial with closed eyes and ears (Powell and Zielinski 1994). By two weeks, light silver-gray hair covers the body and by 3 weeks they are brown (Powell and Zielinski 1994). Kits are entirely dependent upon their mother's milk until 8-10 weeks old, and by ten weeks the kits wean (Powell 1993, Powell and Zielinski 1994). The mother becomes increasingly active as kits grow in order to provide enough food (Arthur and Krohn 1991, Powell 1993). After about four months, the mother begins to show aggression towards kits and the kits begin killing their own prey; by one year kits will have developed their own home ranges (Powell 1993, Powell and Zielinski 1994). Based on field observation and microsatellite genetic analysis, Aubry and Lewis (2003) found evidence suggesting that only juvenile male fishers disperse long distances, which if true, has a direct bearing on the rate at which the fisher may be able to colonize formally occupied areas within its historic range.

Fishers have a low annual reproductive capacity. Females breed at the end of their first year, but because of delayed implantation do not produce a litter until their second year. One-year-old males are capable of breeding, but some have questioned whether they are effective breeders (see Powell 1993). Litter sizes generally range from one to four kits, but can be as high as five or six in rare cases (Powell 1993). Not all fishers produce young every year. Truex et al. (1998) documented that of the females in their study area in the southern Sierra Nevada only about 50-60 percent successfully gave birth to young. In their study area on the North Coast, however, 73 percent of females gave birth to young in 1995, but only 14 percent (one of seven) did so in 1996, indicating fisher reproductive rates may fluctuate widely.

VI. Survivorship and Mortality

a. Survival Rates

Truex et al. (1998) reported annual survival rates of Pacific fishers in three study areas in California: the Six Rivers National Forest in the North Coast Ranges, the Shasta-Trinity National Forest in the eastern Klamath Mountains, and the Sequoia National Forest in the southern Sierra Nevada range. Animals were radio-collared and followed for several years, and survival rates were estimated (1) with an index comparing individual fates to the total time all individuals were monitored, (2) by calculating the proportion of individuals living from one year to the next, and (3) by calculating Kaplan-Meier survival estimates for the southern Sierra Nevada study area. For animals with known fates, the North Coast Ranges area had the lowest relative survival index, with only 50 percent of individuals surviving over 8.3 combined-animal monitoring years. In contrast, 35 percent of individuals in the Southern Sierra study area survived over 19.3 monitoring years, and 50 percent of individuals in the Klamath study area survived over 15.7 monitoring years. However, if animals with unknown fates were included and presumed to be alive when calculating relative survival rates, the survival index was highest for the North Coast, intermediate for the Eastern Klamath, and lowest for the Southern Sierra. When annual survival estimates were pooled across years for each study area, overall survival was lowest for the Southern Sierra and highest for the North Coast.

Annual survival rates ranged from 61.2 percent, 72.9 percent, and 83.8 percent for females, and 73.3 percent, 85.5 percent, and 83.8 percent for males for the Southern Sierra, Eastern Klamath, and North Coast, respectively. Male survival rates were higher than for females. For the Southern Sierra study area, Kaplan-Meier survival rates for two time periods were 0.57 (95% CI = 0.25-0.89) and 0.60 (95% CI = 0.24-0.96) for females and 0.86 (95% CI = 0.45-1.0) and 0.71 (95% CI = 0.38-1.0) for males. Table 1 below summarizes estimates of survival rates in the three study areas. On the Eastern Klamath and Southern Sierra study areas, female survival was lower than male survival, whereas survival was equal for both sexes on the North Coast study area. Of particular concern is the relatively low survival rate of females in the Southern Sierra, an extremely small, geographically isolated population at serious risk of extirpation.

Table 1. Annual survival rates for Pacific fisher from 1994-1996 as documented by Truex et al. (1998). Estimates based on proportion of radio-collared individuals surviving one year to the next, and Kaplan-Meier (95% Confidence Interval) estimates for animals in the southern Sierra Nevada.

Estimation Method	North Coast	Eastern Klamath	Southern Sierra
Annual Proportion Surviving			
Females	83.8%	72.9%	61.2%
Males	83.8%	85.5%	73.3%
Kaplan-Meier			
Females: 1994-1995			57% (0.25-0.89)
Females: 1995-1996			60% (0.24-0.96)
Males: 1994-1995			0.86% (0.45-1.0)
Males: 1995-1996			0.71% (0.38-1.0)

Recent research at the Hoopa Valley reservation has documented an overall decreasing survivorship of females that has changed the sex ratio of the population (Nichol 2006, Hoopa demographic monitoring report; undated). Adult survival on the Hoopa reservation was estimated using program MARK; mean annual survival rates were 0.56 (95% CI 0.452-0.659) for both sexes combined from 1996 to 1998 (Hoopa demographic monitoring report; undated). Female survival was 0.62 (95% CI 0.493-0.725) and male survival was 0.38 (95% CI 0.203-0.598) (Hoopa demographic monitoring report; undated). Survival estimates in 2006 were lower than survival estimates from the 1990s (Coastal Martes Working Group notes; 11 August 2006 field trip to Hoopa reservation). Sex ratio (non-juvenile) was 1 male per 2.4 females in a study conducted in 1997-1998; in 2006 the sex ratio had increased to 1 male per 0.7 females. In 2006, sex ratio of juveniles was 1:1 but became heavily male-biased by about 9 months (Coastal Martes Working Group notes; 11 August 2006 field trip to Hoopa reservation). Decreased survivorship for females and sex ratios favoring males and is a serious issue of concern regarding the long-term survival of the overall fisher population in California.

b. Mortality Factors

Powell (1993) estimated that ten years may be the upper age limit for fishers. Predation and human-caused death appear to be the most important sources of mortality (Powell and Zielinski 1994, Truex et al. 1998). On the Hoopa reservation in 2007, 3 of 12 denning females were killed by predators (Coastal Martes Working Group notes; 14 June 2007). Of 16 mortalities recorded by Truex et al. (1998) where they were able to speculate a cause of death, nine were suspected to be from predation and five were suspected to be human caused, including two vehicle collisions, two cases where the collar was cut (indicating poaching), and one fisher that became trapped in a water tank and died of exposure and/or starvation. Folliard (1997) found the skeletons of eight fishers in a water tank in northwestern California, indicating that such "accidental traps" may be a substantial source of mortality. Where trapping is legal, it is a significant source of mortality. Krohn et al. (1994), for example, found that over a five-year period trapping was responsible for 94 percent of all mortality for a population of the fisher in Maine.

Vehicle collisions appear to be a particularly significant human cause of mortality for the Pacific fisher in California. Two radio-collared males in the Klamath population were killed by automobiles during a study in the 1990s (Truex et al. 1998). In Yosemite National Park, four fishers were found killed by automobiles between 1992 and 1998 (Chow personal communication to N. Greenwald). Zielinski et al. (1995 at p. 110) reported that two road-killed fishers were recovered from 1991 to 1994 in the Sierra National Forest, and that road-killed fishers are "relatively common" in the Sequoia National Forest, according to S. Anderson of the USDA Forest Service.

VII. Habitat Requirements

Studies on the habitat use of fishers in the western United States demonstrate that the fisher is strongly associated with mature and late successional forests (Aubry and Houston 1992, Buck et al. 1994, Dark 1997, Jones and Garton 1994, Mazzoni 2002, Powell and Zielinski 1994, Seglund 1995, Truex et al. 1998, Carroll et al. 1999, Campbell 2004, Zielinski et al. 2004a, 2004b). In particular, fishers are generally found in stands with high canopy closure, large trees and snags, large woody debris, large hardwoods, and multiple canopy layers. Based on an extensive review of existing studies, Buskirk and Powell (1994) concluded:

> "Do American martens and fishers require particular forest types—for example, old-growth conifers—for survival? We think they do. Ecological dependency has been defined in terms of viability of populations, and distributional losses of marten and fisher populations in response to habitat change provide evidence that populations require the habitats that individuals, especially reproductive adults, behaviorally prefer."

The following sections summarize results of existing studies of fisher habitat use while resting, denning, and foraging in the western United States, with particular emphasis on California.

a. Denning and Resting Habitat

Denning and resting habitat is defined as the physical structures that are used by fishers for giving birth and raising kits (denning) and for resting between foraging bouts (resting), as well as the forest characteristics immediately surrounding these structures. Female fishers give birth in natal dens and subsequently move their kits to one or several maternal dens over the breeding season (Nichol 2006). All natal and maternal dens in California's fisher populations have been found in tree cavities, including one in a conifer log (Truex et al. 1998, see citations in Nichol 2006). Female fishers have been observed at resting sites away from natal dens during the breeding season (Truex et al. 1998). Fishers have at least one daily resting occasion, and usually use a different resting structure for each occasion (Zielinski et al. 2004a). Individuals appear to remember rest sites, as they have been witnessed approaching sites directly (Powell and Zielinski 1994), although Zielinski et al. (2004a) found that only 66 of 599 (11 percent) resting structures identified during a radio telemetry study in the Northern Coast Ranges and Southern Sierra Nevada were re-used. Pacific fishers have been documented utilizing tree cavities, platforms, squirrel and raptor nests, logs, rock and brush piles, and even holes in the ground as resting structures (Zielinski et al. 2004a).

Attributes of Denning Sites – Truex et al. (1998) defined natal and maternal dens as rest sites where kits were observed prior to juvenile dispersal. Females exhibit strong selectivity for dens, because

they must find a suitable cavity with an entrance hole small enough to control access by males and to protect their young from predators (Zielinski et al. 2004a). Three studies have described attributes of natal and maternal denning structures for fishers in California. All dens were in cavities of very large live or dead conifer or hardwood trees, and all were standing except one white fir (*Abies concolor*) log (Table 2).

Table 2. Natal and maternal denning sites of Pacific fishers (adapted from Nichol 2006 and Truex et al. 1998).

Study Author(s)	Location	Tree species used for denning*	Average DBH of trees and/or snags used for denning (cm)
Truex et al. 1998	North Coast, eastern Klamath, and southern Sierra Nevada	NC: 1 CADE; 2 PSME; 1 QUKE, 2 ABCO (1 was log) EK: 1 PIPO; 1 QUKE; 2 QUCH; 1 PSME SSN: 3 ABCO; 2 QUKE	NC: 116.8 for conifers; 53 for hardwood EK: 78 for conifer, 60 for hardwoods SSN: 115 for conifers; 63 for hardwoods
Higley and Matthews 2006	Hoopa Valley reservation, northern CA	25 LIDE; 10 PSME; 9 QUKE; 1 CULA; 1 PILA; 1 ARME	76 to 137
Self and Callas 2006	Sierra Pacific Industries lands (location not specified, presumed northern CA)	6 QUKE; 2 QUCH; 1 PSME	47.5 (*Quercus* spp.) to 166.4 (PSME)

*CADE=Incense-cedar, PSME=Douglas-fir, QUKE=Black oak, ABCO=White fir, PIPO=Ponderosa pine, QUCH=live oak LIDE=Tanoak, CULA=Port Orford-cedar, PILA=sugar pine, ARME=Pacific madrone,

Hardwood trees with dens appear to be smaller on average than conifer trees with dens. Truex et al. (1998) reported that of a total of 19 denning sites, eight were in live hardwood trees, six were in live conifer trees, four were in conifer snags, and one was in a conifer log. Overall the average diameter at breast height (DBH) was 114.8 cm for conifers and 62.5 cm for hardwoods. The minimum sized conifer den tree was an 82-cm live white fir, while minimum sized hardwoods were in 40-cm live black oak and live oak. Higley and Matthews (2006) reported the average DBH for birth and pre-weaning natal den trees was 59-113 cm for hardwoods and 102-137 cm for four conifer species, and Self and Callas (2006) reported the DBH of a Douglas-fir snag den site was 166.4 cm (no information was available on average DBH of hardwood tree den sites). Interestingly, Weir and Harestad (2003) found that the average DBH of black cottonwoods in British Columbia used as fisher maternal dens was 103.1 cm, which is larger than the hardwood tree den sites reported in California.

Truex et al. (1998) described habitat conditions surrounding natal and maternal den trees. Canopy closure ranged from 70 to 100 percent, and basal area ranged from 18.3 m^2/ha (at the eastern Klamath site, around a black oak den) to 166.3 m^2/ha (around a den in a white fir snag at the North Coast site). Average basal area was 75.6 m^2/ha for the North Coast sites, 62.6 m^2/ha on the Southern Sierra site, and 59.8 m^2/ha on the Eastern Klamath (Truex et al. 1998).

Attributes of Resting Sites – Resting structures protect fishers from inclement weather conditions and predators. Therefore "choosing a resting site may be among the most important choices made by fishers outside the breeding season," (Zielinski et al. 2004a at p. 476). Using radio-telemetry, Truex et al. (1998) and Zielinski et al. (2004a) found that approximately 75 percent of resting structures in the North Coast, the Eastern Klamath, and the Southern Sierra were in standing trees, and most of these were >100-cm DBH, with live trees constituting 46.4 percent of structures. These trees were significantly larger on average than the trees that were available within their home ranges (Zielinski et al. 2005a). Over 40 percent of rest sites in the Southern Sierra were in hardwoods, which was nearly twice the use of hardwoods in northern California. The authors postulated that oak ecosystems provide high-quality food for fisher prey. Mazzoni (2002) also found that black oaks and white firs were preferred resting sites, along with ponderosa pine, in the southern Sierra. While male and female fishers rested most often in trees in both regions, Zielinski et al. (2004a) and Truex et al. (1998) reported greater use of rock piles and other ground cavities in the Southern Sierra compared to Northern California. Furthermore, males used platforms more often than females, while females used snags more frequently than males. In sum, fishers most frequently rested in live trees, followed in order of importance by snags, platforms, and logs. Rock piles, subnivean sites and holes in the ground were utilized less frequently. Douglas-fir was by far the most

common species used for resting in both northern California sites, whereas oaks and true firs were most commonly used in the southern Sierra.

The average DBH of trees and snags used by fishers for resting in numerous studies in California was 79.7 to 118.5 cm for conifers and 67.1 to 103.2 cm for hardwoods (Table 3). Approximately 80 percent of all logs used as rest sites by fishers were over 76 cm DBH. Other studies from the West Coast have found similar results (Table 3). Appropriate rest sites must be widely distributed throughout home ranges of fishers because they are typically used for only one rest or sleep (Powell and Zielinski 1994, Truex et al. 1998, Zielinski et al. 2004a).

Table 3. Average diameter of trees used for resting by Pacific fishers in several studies.

Study Author	Location	Average DBH of trees and/or snags used for resting (cm)
Buck et al. 1983	Northern California	114.3
Truex et al. 1998	North CA Coast, eastern Klamath, and southern Sierra Nevada	98.2 for conifers; 67.1 for hardwoods
Higley 1998	Hoopa Valley reservation, northern CA	110 for conifers; 74.6 for hardwoods
Mazzoni 2002	Southern Sierra Nevada	95 for snags; 116 for live trees
Weir and Harestad 2003	Southern British Columbia	78.7 for conifers; 103.2 for hardwoods
Zielinski et al. 2004a	North CA Coast, Southern Sierra Nevada	118.5 for conifers; 69 for hardwoods

While the resting structure itself is assumed to be a primary attractant for a fisher, a number of environmental features in the surrounding habitat are associated with the selection of a roosting location (Zielinski et al. 2004a). Resting sites are typically located within stands dominated by late-successional forest characteristics, such as large trees and snags, coarse woody-debris, high canopy closure, and multiple canopy layers (Truex et al. 1998, Zielinski et al. 2004a). Truex et al. (1998) documented high mean canopy closure and high mean DBH of the four largest trees in stands surrounding fisher rest sites on three study areas in California (Table 4).

Table 4. Attributes of stands surrounding Pacific fisher rest sites as documented by Truex et al. (1998).

Stand Attribute	North Coast	Southern Sierra	Eastern Klamath
Mean canopy closure	93.9%	92.5%	88.2%
Mean DBH of the four largest trees	118.3 cm	89.6 cm	46.2 cm

Zielinski et al. (2004a) concluded that canopy cover, DBH, and slope are the most significant variables explaining the differences between fisher resting and random sites. Resting sites had significantly larger maximum DBH, higher average canopy closure and shrub canopy closure, more large snags, and steeper slopes than random sites. Conifers and hardwoods were smallest at random sites, larger in stands surrounding resting sites, and largest when used as resting structures (Zielinski et al. 2004a). Similarly, Mazzoni (2002) found that canopy cover, tree basal area, distance from water, and crown volume were the most significant indicators of fisher rest sites in the southern Sierra. In northern California, the presence of large conifer snags was also important, while in the southern Sierra, the presence of water and hardwoods was significant (Zielinski et al. 2004a). Similarly, Dark (1997) found that stands surrounding fisher rest sites have greater amounts of 50-75 percent canopy cover, fewer disjunct core areas, and more Douglas-fir than areas where fishers were not detected, and Seglund (1995) found that the fisher used rest sites with greater basal area per square meter, a higher percentage of dead and down woody debris, a greater average DBH of the four largest trees, and a greater number of vegetation layers (multiple canopy layers) on plots surrounding rest sites compared with sites where fishers were not detected. These characteristics are all typical of late-successional forests.

The Pacific fisher is probably associated with late-successional forest conditions because these stands contain the large trees, snags, and logs used by fishers as rest or den sites (Powell and Zielinski

1994, Truex et al. 1998, Zielinski et al. 2004a). Cavities in large old-growth trees and high canopy cover surrounding these structures likely protect fishers from hot, dry weather conditions typical of forests in California (Zielinski et al. 2004a). As outlined above, fishers generally rest in or on live trees, snags, or logs with cavities, broken tops, large limbs, mistletoe brooms, or platforms made by raptors or squirrels. These characteristics are usually only found on large, old trees. Commenting on the significance of use of large trees and snags for resting and denning to the conservation of the fisher and its habitat, Powell and Zielinski (1994) concluded:

> "Large physical structures (live trees, snags, and logs) are the most frequent fisher rest sites, and these structures occur most commonly in late-successional forests. Until it is understood how these structures are used and can be managed outside their natural ecological context, the maintenance of late-successional forests will be important for the conservation of fishers."

b. Foraging Habitat

Foraging habitat requirements are difficult to study because it is harder to locate moving animals and because once they are located it is difficult to determine whether or not they are simply traveling through an area or actively hunting. Despite such limitations, habitat characteristics surrounding baited track plate stations where fishers have been detected are often used as a proxy to describe foraging habitat (Powell and Zielinski 1994, Seglund 1995, Aubry et al. 1996, Carroll et al. 1999, Zielinski 1999, Dark 1997, Mazzoni 2002, Weir and Harestad 2003, Campbell 2004). Presumed foraging habitat, similar to resting and denning habitat, is often typified by characteristics associated with mature and late-successional forests (Dark 1997, Jones and Garton 1994, Zielinski 1999). Zielinski (1999) documented that fishers on the North Coast of California foraged in stands with greater basal area, a wider range of tree sizes (based on greater DBH standard deviation; this factor suggests presence of multiple canopy layers), and significantly higher canopy closure (average of 91.7 percent for sites with detections compared to 79.0 percent sites without detections) than stands where fishers were not found, and that fishers in the southern Sierra foraged in stands with higher canopy closure of trees and shrubs than stands where fishers were not found. Dark (1997) found no differences between fisher resting locations and track-plate locations, potentially indicating that fishers use late-successional habitats for all activities, including resting, traveling, and foraging. Campbell (2004) reported that microhabitats where fishers were present at baited stations in the Sierra Nevada tended to have larger conifer and hardwood trees, steeper slopes, more shrub cover, and fewer roads than areas where no fishers were detected. At the landscape level, sample units within the fisher detection area were negatively associated with precipitation, road density, and discontinuity of habitat (Campbell 2004). In contrast to Campbell (2004), Weir and Harestad (2003), in their study of radio-collared fishers in British Columbia, found that fishers avoided stands with >80 percent closure of the low shrub layer. They hypothesized that very high shrub cover may negatively affect hunting success.

Conversely, Klug (1997) found no difference in age between stands where fishers were detected at track plate stations and where fishers were not detected, and thus found no relationship between fishers and late-successional forests in his study on private timber lands in coastal northern California. However, Klug noted that there was very little old-growth in his study area (<2 percent) and that track plate surveys are unable to detect whether or not fishers are using the area incidentally or regularly. Powell and Zielinski (1994) concluded:

> "While some recent work in northern California indicates that fishers are detected in second-growth forests and in areas with sparse overhead canopy, it is not known whether these habitats are used transiently or are the basis of stable home ranges. It is unlikely that early and mid-successional forests, especially those that have resulted from timber harvest will provide the same prey resources, rest sites and den sites as more mature forests."

A number of studies have shown that fishers avoid areas with little forest cover or significant human disturbance and prefer large areas of contiguous interior forest (Dark 1997, Jones and Garton 1994, Powell 1993, Rosenberg and Raphael 1986, Carroll et al. 1999, Seglund 1995, Weir and Harestad 2003). Seglund (1995) found that a majority of fisher rest sites (83 percent) were further than 100 m from human disturbance and Dark (1997) documented that fishers used and rested in areas with less habitat fragmentation and less human activity. Rosenberg and Raphael (1986) found that presence of fishers was highly correlated with stand insularity and that they "decreased sharply in frequency of occurrence in stands <100 ha." Lastly, Freel (1991) determined, based on a review of studies, that high-quality habitat

was characterized by a road density less than one half mile to every square mile. Fishers probably avoid open areas because they are more vulnerable to potential predators without forest cover and because in winter open areas have deeper snow, which is believed to make travel inefficient (Krohn et al. 1997, Powell 1993, Weir and Harestad 2003). Conversely, fishers are probably associated with habitat with contiguous forest cover because this is where they find sufficient available prey and suitable resting and denning sites (Powell 1993, Powell and Zielinski 1994). The U.S. Fish and Wildlife Service's 12-month finding for a petition to list the west coast distinct population segment of the fisher; Federal Register April 8, 2004 (at p. 18774), cites literature making clear the relationship between fisher and closed canopy conditions:

> "The fisher's need for overhead cover is very well-documented. Many researchers report that fishers select stands with continuous canopy cover to provide security cover from predators... Fishers may use forest patches with large trees because the overstory closure increases snow interception... Forested areas with higher density overhead cover provide the fisher increased protection from predation and lower the energetic costs of traveling between foraging sites. Fishers probably avoid open areas because in winter open areas have deeper, less supportive snow which inhibits travel … and because they are more vulnerable to potential predators without forest cover... Furthermore, preferred prey species may be more abundant or vulnerable in areas with higher canopy closure..."

Several studies have shown that fishers are associated with riparian areas (Aubry and Houston 1992, Dark 1997, Seglund 1995, Zielinski 1999, Zielinski et al. 2004a). For example, Aubry and Houston (1992) noted that many of the past sightings of the fisher in Washington State were in riparian areas or wetlands. This is probably because riparian forests are in some cases protected from logging and are generally more productive, thus having the dense canopy closure, large trees, and general structural complexity associated with fisher habitat (Dark 1997). Zielinski et al (2004a) found that proximity to water was an important variable in the resting site selection by southern Sierran fishers, possibly because fishers prefer mesic sites in this relatively dry habitat.

In sum, fishers in the western United States are habitat specialists associated with forests exhibiting late-successional characteristics, such as an abundance of large trees, snags, and logs (>100 cm DBH), multiple canopy layers, high canopy closure, and few openings (Dark 1997, Freel 1991, Powell and Zielinski 1994, Seglund 1995, Truex et al. 1998, Carroll et al. 1999, Mazzoni 2002, Zielinski et al. 2004a). In combination with their avoidance of human disturbance, this association makes the fisher highly sensitive to anthropogenic habitat loss and fragmentation related to logging, development, and other factors. Based on a survey of fisher distribution in Washington and a review of other studies, Aubry and Houston (1992) concluded:

> "We predict that available habitat for fishers would be enhanced by minimizing forest fragmentation, maintaining high forest-floor structural diversity, preserving snags and live trees with dead tops, and protecting swamps and other forested wetlands."

Indeed, elimination of late-successional forest characteristics from large portions of the Sierra Nevada and Pacific Northwest (Aubry and Houston 1992, McKelvey and Johnson 1992, Morrison et al. 1991, Franklin and Fite-Kauffman 1996) has probably contributed to the significant diminution of the fisher's historic range on the West Coast (Lewis and Stinson 1998).

c. Home Range

Fishers have large home ranges, with ranges of males considerably larger than those of females (Kelly 1977, Buck et al. 1983, Truex et al. 1998, Zielinski et al. 2004b). Male and female home-range sizes in the southern Sierra, based on minimum convex polygons, averaged 2,998 ha and 528 ha, respectively, in one study (Zielinski et al. 2004b), and 2,194 ha and 1,192 ha, respectively, in another study (Mazzoni 2002). Average home-range sizes in northern California were 5,807 has for males and 1,498 ha for females (Zielinski et al. 2004b). Home-range size likely varies with quality of habitat. Truex et al. (1998) compared fisher home-range sizes in three study areas and found that they were largest in the eastern Klamath where habitat quality was generally considered poor. They concluded:

> "Individuals are expected to use larger areas in poorer quality habitat and therefore to exist at lower densities. Both of these indices support the relatively lower quality of habitat on the eastern Klamath study area than the North Coast or Southern Sierra Studies."

High canopy closure appears to be an important feature of fisher home ranges. Zielinski et al. (2004b) found that the 66.3 percent of fisher home ranges were comprised of 60-100 percent canopy cover. However, home ranges of females included a larger proportion of the densest canopy closure class (71.1 percent of the home range) than home ranges of males.

Based on a review of eight studies of fisher home-range size, Freel (1991) determined that supporting a reproductive unit of fishers, including the home ranges of one male and two females, would require 2,428 ha (6,000 ac) in high capability habitat with 70-80 percent in mature, closed conifer forest; 3,966 ha (9,800 ac) in moderate capability habitat with 61-80 percent in mature, closed conifer forest; and 4,573 ha (11,300 ac) in low capability habitat with 50-60 percent in mature, closed conifer forest. Carroll et al. (1999) compared fisher locations with habitat variables at the scale of the stand, landscape, and region and found that habitat variables at landscape and regional scales predicted fisher distribution as well as a model incorporating fine-scale habitat attributes, potentially indicating that the fisher may be selecting habitat at the home-range scale or above. At the landscape scale, fisher distribution was strongly associated with landscapes with high levels of tree canopy cover (Carroll et al. 1999).

HISTORICAL AND CURRENT DISTRIBUTION

In California, the fisher historically ranged throughout the Sierra Nevada from the Greenhorn Mountains in northern Kern County to the southern Cascades at Mount Shasta. From there, they ranged west into the North Coast Ranges and Klamath Mountains from Lake and Marin Counties north to the State line (Figure 1 and Grinnell et al. 1937). In the Sierra Nevada, the fisher occurs from roughly 600-2,600 m with occasional sightings up to 3,000 m (Grinnell et al. 1937, Zielinski et al. 1997a). In northern California, fishers are occasionally seen at sea level, but more commonly occur from 600-1,700 m (Grinnell et al. 1937, Zielinski et al. 1997a). The upper elevational limit of the fisher's range generally corresponds with those areas that receive significant winter snowfall, where it is believed fishers are not able to travel efficiently (Krohn et al. 1997). Throughout California, fishers occur in mixed conifer, Douglas-fir, and ponderosa pine forest types (Zielinski et al. 1997a, Zielinski et al. 2000). Based on systematic surveys conducted from 1996-1999 in forested areas of northwestern California, the Sierra Nevada and southern Cascades, Zielinski et al. (2000) determined that of all fisher detections roughly 45 percent were in the pine type, 18 percent were in the mixed conifer type, 11 percent were in the true fir type, and 25 percent were in the Douglas-fir type, according to CWHR habitat types. In addition, Beyer and Golightly (1996) detected fishers at track plate stations in the coast redwood zone, but detection ratios were lower than in other habitats. Fishers, however, were commonly detected in mixed redwood/Douglas fir forest and coastal forests comprised of Sitka spruce, red alder, and occasional coast redwood (Beyer and Golightly 1996).

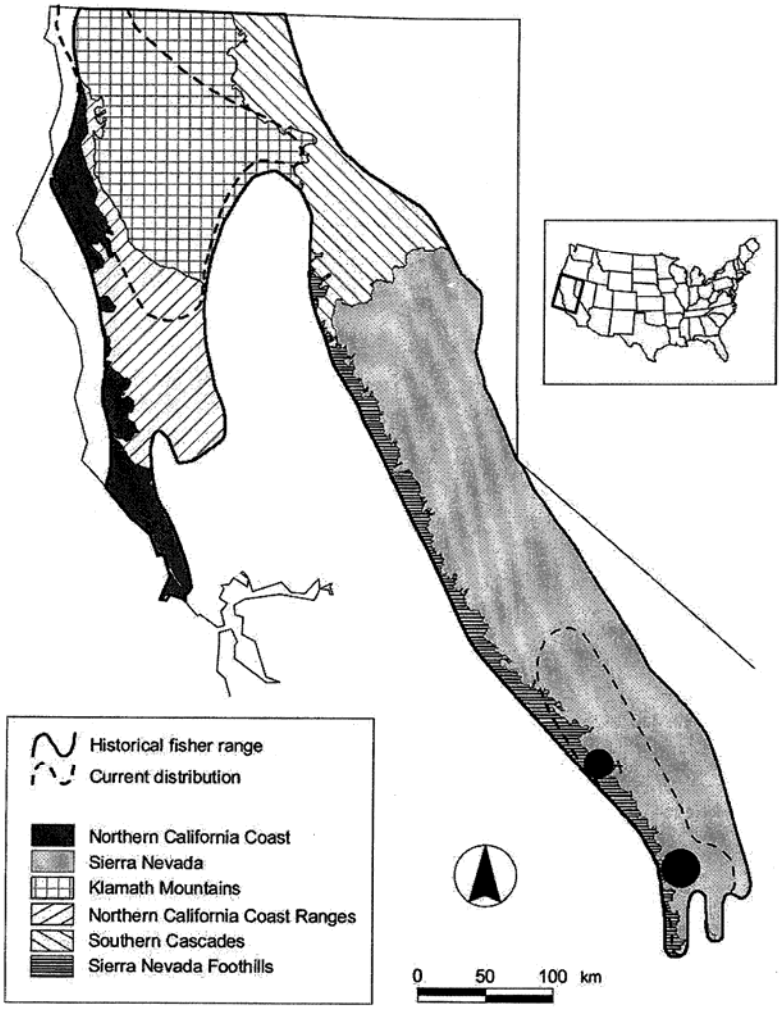

Figure 1. Map of the fisher's historic and current range in North America from Zielinski et al. (2005a).

The fisher's range has declined to roughly 50 percent of its historic range in California (Zielinski et al. 1997a, Zielinski et al. 2005a). In particular, researchers have failed to detect fishers north of Yosemite Park during extensive surveys using remote cameras and track plates, suggesting that the fisher is extirpated or occurs at extremely low densities in the central and northern Sierra Nevada (Figure 2; Truex et al. 1998, Zielinski et al. 1997b, 2000, 2005a, Campbell 2004). This has effectively isolated fishers in the southern Sierra Nevada from fishers in northern California by a distance of roughly 430 km (Lamberson et al. 2000, Zielinski et al. 2005a), which is more than four times greater than the observed maximum dispersal distance for fisher of 100 km (Arthur et al. 1993, York 1996).

The Sierra Nevada Forest Plan Accomplishment Monitoring Report for 2005 reported annual occupancy rates were consistently higher on the Sequoia National Forest (33.3-41.1 percent annual occupancy) than the Sierra National Forest (14.5-22.7 percent annual occupancy), and that detection rates were similar over four years: in 2002 the detection rate was 0.268, in 2003 it was 0.234, in 2004 it was 0.238, and in 2005 it was 0.248. In the last decade, detections of fisher were most common in the extreme southern Sierra, especially in Tulare County where in one study 26 of the 30 sampling units with fisher detections occurred (Zielinski et al. 2005a; Figure 2). In fact, Zielinski et al. (2005a at p. 1395) noted of all the carnivore species detected during their surveys, "the distribution of the fisher appears to have changed more than any of the species." Importantly, Zielinski et al. (2005a) further state that it is likely that the fisher population was *already reduced* by the time Grinnell et al. (1937) assessed the distribution of the species, due to a combination of extensive logging of habitat and the high price for fisher pelts. Zielinski et al. (2005a at p. 1403) stated that "the paucity of fisher records in the southern Cascades and northern Sierra Nevada may be because fishers, coveted by trappers, had already been trapped out by the time their status was first assessed." Thus, the historic fisher population was likely larger than what is considered baseline from Grinnell et al. (1937), and may not represent the distribution of fishers prior to European settlement of California. Campbell et al. (2004) and Zielinski et al. (2005a) also found that two carnivore species sympatric with the fisher are apparently extinct throughout the Sierra Nevada, and possibly the entire state: the wolverine (*Gulo gulo*) and the Sierra Nevada red fox (*Vulpes vulpes*).

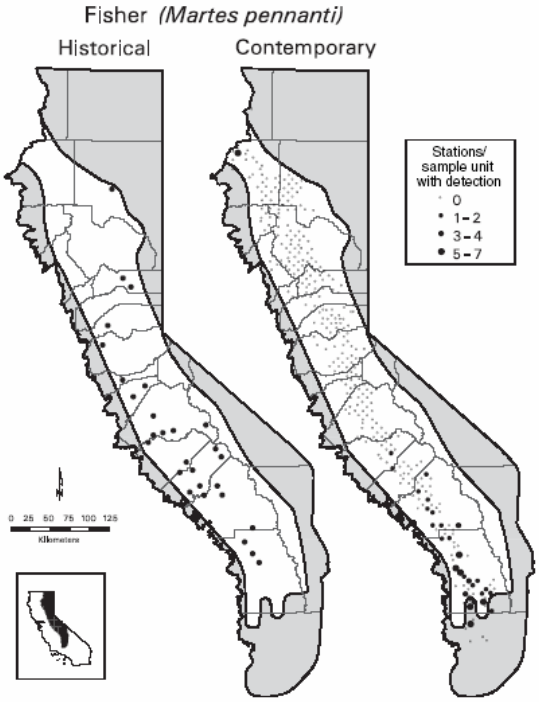

Figure 2. Distribution of historical records (left) and contemporary survey data from 1992-2002 (right) for the Pacific fisher in the Sierra Nevada. Historical range indicated by bold black line; gray dots on contemporary map are sample units where no fishers were detected; black dots represent stations with detections. From Zielinski et al. 2006.

Loss of the fisher from the northern Sierra Nevada was likely caused by a combination of many factors, including more than a century of logging with concurrent road building, rapid population growth, development and trapping prior to 1946 (Duane 1996a, McKelvey and Johnson 1992, Lamberson et al. 2000, Campbell 2004, Zielinski et al. 2005a). Compared with the American marten (*Martes Americana*), a congeneric, late-successional forest specialist, the fisher occurs at lower elevations putting it in greater proximity to human development and forest-altering activities (Zielinski et al. 2005a). Truex et al. (1998) conclude that "for all intents and purposes the southern Sierra is a demographically closed population." This conclusion is supported by the recent genetic work by Wisely et al. (2004), which suggests that fishers along the Pacific coast have the highest reported level of genetic structure in a mammalian carnivore. Populations from Northern California and the southern Sierra Nevada are highly differentiated, and there is little migration among populations from north to south (Wisely et al. 2004). In addition, the population south of the Kings River is thought to be almost completely isolated from populations to the north of the river (Wisely et al. 2004). In part because of its extreme isolation, the southern Sierra Nevada population is believed to be at substantial risk of extinction (Truex et al. 1998, Lamberson et al. 2000).

The distribution of fishers relative to potentially competing carnivore species is an important consideration for the recovery of the fisher into areas from which it has been extirpated. The fisher may exhibit significant ecological overlap with competing carnivores due to its large home-range size and generalist diet (Campbell 2004). In an intensive survey of mammalian carnivores in the central and southern Sierra Nevada conducted from 1996-1998, Campbell (2004) found that striped skunk and gray fox – two species similar in size to fishers – were detected much less frequently in the area where fishers persist, and much more frequently in the central Sierra Nevada where fishers have been extirpated. The author stated (at p.41) that "areas where mature forest is less abundant would tend to favor more generalist species such as the striped skunk, opossum, and gray fox, all of which occur more frequently at sites in the northern portion of the study area where fishers are absent." Campbell also cautioned that competition with resident carnivores, together with the degradation of late-seral forests due to logging, roads, and development, may be hindering recolonization of the northern Sierra Nevada by fishers.

In northwestern California, the range of the Pacific fisher has contracted northward and now extends only as far south as northern Mendocino County (Zielinski et al. 2005a). In 2000, surveys conducted on the Mendocino National Forest in conjunction with planned timber harvest activities found fishers at a northern site but not at a southern site (Weinberg and Paul 2007). The surveyors speculated that the differences in occupancy may be due to several factors, such as differences in annual precipitation between sites, or because the southern site may be south of the range of large, contiguous blocks of suitable habitat that occurs at the northern, higher-elevation watersheds of the Mendocino National Forest. Moreover, the southern site contained a popular, heavily-used motocross trail network that may have caused fishers to abandon the area (Weinberg and Paul 2007). Surveys in Jackson State Forest in 2006 found no detections (Coastal Martes Working Group notes; 4 October 2006).

Fishers in California are also almost certainly isolated from the larger continental population. Extensive survey and sighting information strongly indicates that the fisher has been extirpated from extensive portions of Oregon and Washington (Aubry and Houston 1992, Aubry et al. 1996, Lewis and Stinson 1998), isolating the remaining populations in northwestern California, the southern Sierra Nevada, and southern Oregon from those in central British Columbia and the Rocky Mountains by at least 800-1,000 km. Although evidence indicates that scattered individual fishers may occur in Washington, it is unlikely that these individuals could facilitate genetic exchange between remaining fisher populations in California and Oregon and the larger continental population. Microsatellite and mitochondrial DNA studies of fisher populations along the west coast support this assumption (Drew et al. 2003, Aubry and Lewis 2003, Wisely et al. 2004). All California fisher populations are differentiated mitochondrially from each other, and from other populations in southern Oregon and British Columbia (Drew et al 2003). More interestingly, there has been no genetic exchange between the population in Oregon's Siskiyou Mountains and the introduced population in the southern Oregon Cascade mountains (Aubry and Lewis 2003, Wisely et al. 2004), suggesting that there is not enough suitable habitat between these two populations to facilitate dispersal.

ABUNDANCE AND POPULATION TRENDS

Four studies of fisher demography in California have been conducted, including one study of the southern Sierra Nevada population and three of the northern California populations – in the Northern Coastal Range and in the Eastern Klamath (Truex et al. 1998) and on the Hoopa Indian Reservation (Hoopa demographic monitoring report; undated). These studies utilized radio-collared fishers to study reproduction, survival, and habitat use. In addition, the Forest Service began conducting monitoring of fisher populations in the Sierra Nevada in 2002, including intensive sampling on Sierra and Sequoia National Forests designed to monitor population trend, and less intensive sampling at sites in the central and northern Sierra (the area assumed to be unoccupied by fisher) focused on documenting population expansion (USDA 2006). The basic monitoring objective is to detect 20 percent declines in population abundance and habitat across the Sierra Nevada. These Forest Service survey detections were used to generate a population estimate of the southern Sierra population (Spencer et al. 2007). Although these studies have only begun to gain insight into fisher population ecology, preliminary estimates of mortality and survival indicate that remaining Pacific fisher populations, particularly in the southern Sierra, are at significant risk of extinction.

Overall, the abundance of Pacific fisher in the southwestern Oregon-northwestern California population is estimated to be fewer than 750 individuals (Nichol 2006). The southern Sierra Nevada population is estimated to contain about 100 to 500 individuals (Lamberson et al. 2000) with potentially 50 remaining females. Given that the northern California population estimate includes animals in southwestern Oregon as well, the extant Pacific fisher population in California probably numbers a maximum of 1,250 individuals, but could potentially be as low as 850 or less.

I. Southern Sierra Nevada Population

Several factors place the fisher population in the southern Sierra at serious risk of extinction, including isolation, small population size, demographic and environmental stochasticity, low reproductive capacity, and ongoing habitat loss (Truex et al. 1998, Lamberson et al. 2000). As noted above, this population is isolated from others by approximately 430 km and as a result, there is a low probability that it could be rescued through migration of individuals from other populations were it to decline further because of demographic stochasticity, catastrophes, or other factors. Truex et al. (1998) conclude:

> "Recolonization of the central and northern Sierra Nevada may be the only way to prevent fisher extinction in the isolated southern Sierra Nevada population."

Further, without immigration the southern Sierra population may be susceptible to inbreeding depression. Indeed, genetic studies using mitochondrial DNA sequencing and nuclear DNA fingerprinting indicate dangerously low genetic variability in southern Sierra Nevada fishers (Drew et al. 2003, Wisely et al. 2004).

In addition to being isolated, the southern Sierra Nevada population is extremely small, including probably no less than 100 individuals, but almost certainly fewer than 360 (Lamberson et al. 2000, Spencer et al. 2007). Spencer et al. (2007) recently used three habitat-based approaches to generate estimates of fisher population size in the southern Sierra. The first approach was to extrapolate fisher density estimates (derived from ground surveys from one area) over the entire southern Sierra area predicted to be suitable based on habitat models from existing literature. The only available density estimate was from the Kings River Project study area, which documented a total density of 10-13 fishers per 100 km^2. This method generated an estimate of 57-86 adult females and 285-370 total fishers throughout the region south of the Merced River. Another approach used by Spencer et al. (2007) was to use sampling theory to calculate annual fisher occupancy rates from regional surveys, adjusted for detectability and total number of fishers detected at each sample unit, to estimate a total population size. Sampling theory yielded an estimate of 160-250 total adult and subadult fishers in the study area. A third approach taken by Spencer et al. (2007) involved inputting parameters derived from previous fisher population modeling studies into the spatially explicit population model PATCH to estimate carrying capacity (equilibrium population size and distribution) of fishers in occupied areas and to identify potential source, sink, and expansion areas. PATCH combines birth, death, and dispersal rates and territory size with spatially explicit habitat values to model territory occupancy by females over time. This method estimated that the currently occupied habitat areas in the southern Sierra Nevada can support approximately 71-147 adult females. The range for adult

female fishers was based on a minimum number of females at equilibrium using a 1,200-ha territory size, up to the maximum number of females using an 860-ha territory size. Based on a 1:1 sex ratio, Spencer et al. (2007) then estimated a population size of about 142-294 total adult fishers, and accounting for subadult animals provide an approximate estimate of 220-360 total fishers. However, the authors note that a 1:1 sex ratios is potentially too large: research on the Kings River Project study area documented a sex ratio of 4 males:6 females, and Dr. Reginald Barrett estimated that there were likely 2-3 territorial females per male because male territories average about 3 times larger than females and males of polygamous species experience greater mortality than females (Spencer et al. 2007). Spencer et al. (2007 at p. 38-39) noted that "equilibrium population size for fishers in the southern Sierra Nevada south of the Merced River [based on current habitat suitability models] is *no more* than about 294 adults, and all things considered, is more likely in the range of 150 to 250 individuals." Spencer et al. (2007 at p. xxii) concluded that:

> "*the fisher population in the southern Sierra Nevada (ignoring juveniles) is between 160 and 360 total individuals (and probably less than 300). Of these, about 57 to 147 (and probably less than 120) are adult females, which comprise the most important class for sustaining a population*." Emphasis in original.

The PATCH approach also identified areas that might support important high-quality core habitats, critical landscape linkages, or movement corridors. Potential source habitats were well-distributed in larger, more contiguous areas of high-value habitat, and sink habitats tended to be in more peripheral and isolated habitat areas (Spencer et al. 2007).

Generally, a population size of 500 breeding pairs composed of 2,000-3,000 individuals is considered the absolute minimum to maintain population viability (Lande and Barrowclough 1987, Lande 1993). Populations well below this minimum, like the southern Sierra fisher population, are at risk of extinction solely from demographic and environmental stochasticity, independent of deterministic factors, such as anthropogenic habitat loss. Random fluctuations in gender ratio, fecundity or mortality; inbreeding depression; and/or droughts, cold weather, heavy snow years, and other temporal environmental changes can lead to declines that in small populations result in rapid extinction. These factors present very real threats to the long-term survival of the isolated southern Sierra fisher population (Lamberson et al. 2000). Catastrophes, such as severe storms or disease epidemics, magnify risk of extinction further (Schaffer 1987, Lande 1993). Indeed, Spencer et al. (2007 at p. 41) stated that "given that this small population does not experience immigration from other regions, it is at risk of extirpation by a variety of stochastic influences, and likely needs to grow to avoid extinction."

Although little is known about fisher demography, what is known is a cause for serious concern. Fishers have very low reproductive capacity. After two years of age they generally produce only one to four kits per year and only a portion of all females breed (Powell 1993, Truex et al. 1998, Lamberson et al. 2000). Low fecundity means that fisher populations are slow to recover from population declines, further increasing risk of extinction. Of even greater concern, Truex et al. (1998) documented that adult female fishers in the southern Sierra Nevada have a very low annual survival rate, which from 1994-1996 was 61.2 percent. Of all demographic parameters, female survival has been shown to be the most important single factor determining fisher population stability (Truex et al. 1998, Lamberson et al. 2000). If high female mortality continues, it is unlikely that the fisher will persist in the southern Sierra Nevada and indeed Truex et al. (1998) conclude "high annual mortality rates raise concerns about the long-term viability of this population."

Lamberson et al. (2000) used a deterministic, Leslie stage-based matrix model to gauge risk of extinction for the southern Sierra Nevada population of the fisher and found that the population has a very high likelihood of extinction given reasonable assumptions with respect to demographic parameters. They concluded:

> "In our model population growth only occurs when parameter combinations are extremely optimistic and likely unrealistic: if female survival and fecundity are high, other parameters can be relaxed to medium or low values. If female survival and fecundity are medium and all other parameters high, a steady decline toward extinction occurs."

At this time, all evidence indicates that female survival and fecundity are not high and thus the southern Sierra population of the fisher has a very high probability of extinction over a relatively short

period of time (10-50 years). Further, the model used by Lamberson et al. (2000) assumes there is no demographic stochasticity and that the environment is stable, and does not consider potential loss of fitness associated with loss of genetic variability (Brook et al. 2002). All of these factors would tend to make population predictions more dire (Lamberson et al. 2000). In particular, changes to the environment from further habitat loss and fragmentation due to logging, road building, and urban development are likely to cause additional population declines, bringing the fisher closer to extinction. Truex et al. (1998) concluded:

> "High natural mortality rates and altered forest structures are risk factors that are compounded by the fact that fishers in the southern Sierra Nevada are separated from those in northern California by a distance of at least 400 km. Thus, the population will probably receive no immigrants to augment its genetic diversity or to rescue it from random events that could lead to its extirpation. Special consideration should be given to the effects of all land management activities on the short and long-term viability of this isolated population."

II. Northern California Population

Three studies of fisher demography have been conducted in northern California—one in the Northern California Coast Ranges (North Coast Study) on the Six Rivers National Forest (1992-1997), another in the eastern Klamath Mountains on the Shasta-Trinity National Forest (1992-2000) (Truex et al. 1998), and a third on the Hoopa Indian Reservation (Hoopa demographic monitoring report; undated). These studies indicate that fisher mortality may be high in northern California and suggest that continuing habitat loss and fragmentation may be harming the existing population. In addition, the northern California population is isolated from fisher populations in the rest of North America and small enough that inbreeding and population viability may be serious problems.

One recent estimate for the northern California population is <750 individuals (Nichol 2006). Similar to the southern Sierra, the small size of the northern California population is cause for concern, particularly considering that the population is isolated from the larger continental population, has high female mortality, and continues to experience habitat loss (Truex et al. 1998).

Because of loss of the fisher from most of Oregon and Washington, fishers in northern California are reproductively isolated from fishers in the rest of North America. This isolation precludes genetic interchange, increasing the vulnerability of the northern California population. Drew et al. (2003) documented that fishers in California already have lower genetic diversity than other populations in North America. Lower genetic diversity could be associated with adaptation to local conditions, but is more likely the result of reduction of population numbers with habitat loss (Drew et al. 2003), and may be resulting in reduced population fitness. Furthermore, isolation makes it unlikely that in the event of population decline, immigration from other populations could temporarily augment the population, rescuing it from extinction.

Vulnerability of the northern California fisher population is exacerbated by relatively high mortality rates, particularly among females. Research at the Hoopa Valley reservation has documented an overall decreasing survivorship of females that has changed the sex ratio of the population (Nichol 2006, Hoopa demographic monitoring report; undated). Truex et al. (1998), for example, concluded: "the higher female than male mortality rates, across all three study areas, raises concern." On the North Coast study area, survival rates pooled across years were 83.8 percent for both females and males (Truex et al. 1998). If fishers with unknown fates were included, however, survival rates were considerably lower. Using the effort-based method, the survival index was 50 percent individual survival over 8.3 animal monitoring years (Truex et al. 1998). On the Eastern Klamath study area, survival rates pooled across years were 72.9 percent for females and 85.5 percent for males (Truex et al. 1998). Although population growth rates have not been modeled, high female mortality in combination with low and highly variable observed fecundity rates (Truex et al. 1998) indicate that fisher populations in northern California are probably declining or will do so in the future. Significantly, humans were the cause of half of the known mortalities in northern California in this study, including two fatalities to collision with automobiles and two from hunters.

There is additional evidence of recent fisher population declines in northern California based on intensive mark-recapture research on the Hoopa Indian Reservation. From 1996-1998, trap success on the reservation was 12 percent, but in the same area in 2004-2006 trap success was only 5 percent (see Nichol

2006). In 2007, the reservation documented that 3 of 12 denning females were killed by predators and an additional 3 failed reproduction, possibly due to weather. Moreover, camera stations have demonstrated that fishers per km^2 decreased from 0.35-0.58 in 1997 to 0.16-0.17 in 2005 (Coastal Martes Working Group notes; 14 June 2006).

Finally, the northern California fisher population is vulnerable to past and continued loss of habitat from logging. Logging, for example, is believed to be the cause of lower fisher densities, larger home ranges, low capture rates, and a high proportion of juveniles in the population in the Eastern Klamath study area (Truex et al. 1998). Truex et al. (1998) concluded:

> "Fishers appear to exist in poorer quality habitat in this region than in the others… Some of the differences may be climatic; inland forests receive less moisture and therefore have lower productivity than coastal forests. However, it is clear from the history of timber harvest, and by aerial examination of the three study areas, that the eastern Klamath area has been subjected to more timber harvest—and more by clearcutting—than the other two areas."

If Truex et al. (1998) are correct that low fisher densities in the eastern Klamath relate to logging, continued habitat loss from logging and development may push the population below a sustainable density, whereby Allee effects and demographic stochasticity lead to additional loss of range in California. This would further isolate the two California populations from each other. Moreover, loss of fishers from substantial portions of Oregon and all of Washington in part because of logging (Powell and Zielinski 1994) provides an indication that with continued logging the fisher in northern California is at serious risk.

NATURE, DEGREE, AND IMMEDIACY OF THREAT

I. Timber Harvest

Logging is believed to be one of the primary causes of fisher decline across the United States (Powell 1993) and is probably one of the main reasons Pacific fishers have not recovered in Washington, Oregon, and portions of California (Aubry and Houston 1992, Lewis and Stinson 1998, Truex et al. 1998, Carroll et al. 1999, Campbell 2004, Zielinski et al. 2004a). Moreover, existing and planned timber harvests on both public (Truex and Zielinski 2005) and private (Carroll et al. 1999) lands may further degrade suitable fisher habitat. The following sections detail the method, extent, and probable effect on the fisher and its habitat of logging in the different portions of its California range. In particular, we summarize data from several studies that estimated decline of late-successional and old-growth forests (Morrison et al. 1991, USDI 1990, Bolsinger and Waddell 1993, FEMAT 1993, Franklin and Fites-Kaufmann 1996, Beardsley et al. 1999, Zielinski et al. 2005a). Although fisher undoubtedly can be found in areas not classified as late-successional forest, numerous studies confirm that fishers are strongly associated with unfragmented forests with late-successional characteristics (e.g. Seglund 1996, Dark 1998, Truex et al. 1998). Thus, we have cited studies demonstrating decline of late-successional forests not as an exact measure of loss of fisher habitat, but instead as an indicator of severity of loss of fisher habitat. USDI (1990) took a similar approach in determining threatened status for the northern spotted owl (*Strix occidentalis caurina*), citing studies of old-growth forest decline as evidence of loss of habitat, while also acknowledging:

> "Current surveys and inventories have shown that while northern spotted owls are not found in all old-growth forests, nor exclusively in old-growth forests, they are overwhelmingly associated with forests of this age and structure."

Based on references cited herein, the above statement similarly applies to the fisher.

a. Sierra Nevada

Logging in the Sierra Nevada has resulted in substantial declines in late-successional forests and removal of key components of fisher habitat, including large trees, snags, and downed logs, multi-layered canopies, and high canopy closure, from large portions of the landscape (McKelvey and Johnston 1992, Franklin and Fites-Kaufman 1996, Beardsley et al. 1999, Zielinski et al. 2005a). Removal of these components from Sierra Nevada forests has resulted in loss and fragmentation of fisher habitat, particularly in the northern Sierra Nevada where the fisher appears to be extirpated.

Sierra Nevada forests include extensive areas of both private and federal lands, including seven National Forests in the historical range of the fisher (Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra and Sequoia). Approximately 28 percent of the fisher's historic range in the Sierra Nevada is in private ownership (California GAP Analysis Project 1997). Over 50 percent of the private lands capable of providing the mature coniferous forests preferred by fishers as habitat, however, are industrial timberlands (PRIME California Inventory Data 1997).

Unlike the Pacific Northwest, where the majority of logging was accomplished through clearcutting, logging method has varied in the Sierra Nevada, including clearcut, selection, high-grade, salvage, shelterwood, seed tree, and overstory removal methods (Verner et al. 1992). The effect of these cutting metheds, however, has been largely the same—the removal of late-successional forest conditions from large portions of the landscape. Verner et al. (1992) concluded:

> "Clearcut, seed-tree, and shelterwood cutting techniques all have the same goal: produce even-aged stands. In this regard seed-tree and shelterwood systems can generally be thought of as two-stage (sometimes three-stage) clearcuts. In all of these cutting systems, the original stand will be totally removed before the new stand is scheduled to be cut."

Similarly, on past selective cutting, Verner et al. (1992) concluded:

> "'Selective' harvest in the Sierra Nevada has, in the past, primarily targeted the large trees. This system sometimes called 'pick and pluck,' will not produce the simple, even-aged structures that characterize clearcutting techniques, but its effect on the presence of large, old trees is similar."

Though less prevalent than in the Pacific Northwest, extensive clearcutting has occurred in the Sierra Nevada. Clearcutting was common on Forest Service lands in the Sierra Nevada throughout the 1980s and into the mid 1990s, accounting for most of the volume harvested from 1983 to 1987 (McKelvey and Johnston 1992) and is still occurring on private lands. Regardless of method, logging in the Sierra Nevada has resulted in drastic changes in forest structure across the landscape.

By all accounts, the majority of mixed-conifer and ponderosa pine forests in the Sierra Nevada at the turn of the previous century were characterized by exceedingly large trees and a high degree of structural complexity (Sudworth 1900, Leiberg 1902, McKelvey and Johnston 1992, Franklin and Fites-Kaufmann 1996). Franklin and Fites-Kaufmann (1996), for example, stated:

> "The collective inference from all lines of evidence is that stands with moderate to high levels of LS/OG [late successional / old-growth] -related structural complexity occupied the majority of the commercial forestlands in the Sierra Nevada in presettlement times."

Sudworth (1900) quantified the number, species, and size of all trees over 28 cm (11 inches) DBH on 22 0.1-ha (0.25-acre) plots, of which three were sub-alpine types and thus not of interest in relation to the fisher. The average DBH of trees on the remaining 19 plots was 104 cm (40.9 inches), with individual plots ranging from 65-134 cm average DBH (25.6 to 52.7 inches). Given the predominance of large trees in most Sierran stands, it is likely that there were also considerably more large snags and downed logs than exist on the present landscape (Franklin and Fites-Kaufman 1996). Sudworth's data also indicate that pre-European settlement forests were fairly dense. The average number of trees over 28 cm DBH in the 19 plots measured by Sudworth (1900) was 24 trees with individual plots ranging from 15 to 43 trees. Considering the number and size of trees found in turn-of-the-century Sierran forests as measured by Sudworth (1900), and that according to Beardsley et al. (1999) "the crowns of the species found in mixed conifer are generally broad, thereby resulting in dense canopy cover," it is likely that most pre- European settlement Sierran mixed-conifer forests had fairly high canopy closure. Bouldin (1999) compared Sudworth's data with data from numerous vegetation plots measured in 1935 and determined that Sudworth had probably selected highly productive sites for sampling, biasing his conclusions. Nevertheless, Bouldin similarly concluded that there have been "drastic decreases in trees >36" diameter," supporting the basic contention that Sierra Nevada forests have been substantially altered since European settlement.

Primarily because of logging, present day Sierran forests are drastically different from those described by Sudworth at the turn of the century. Some forest stands once dominated by trees well over 64 cm DBH (25 inches) are now dominated by trees under about 50 cm (20 inches). McKelvey and Johnston (1992), for example, concluded:

> "A comparison of that distribution [Sudworth (1900)] with the largest diameter stands in Sierran forests of today shows that far more of the stand basal area in the forests of 1900 was concentrated in very large trees… To various degrees, the forest system has been changed from one dominated by large, old, widely spaced trees to one characterized by dense, fairly even-aged stands in which most of the larger trees are 80-100 years old."

Sierra Nevada forests also have fewer large snags and logs, an absence of multi-layered canopies, and reduced total canopy cover. Franklin and Fites-Kaufmann (1996) concluded:

> "A logical inference from both the rankings and the tabulated characterizations of the patches developed in the mapping exercise is that large-diameter decadent trees and their derivatives—large snags and logs—are generally absent or at greatly reduced levels in accessible, unreserved forest areas throughout the Sierra Nevada. This reflects the selective removal of the large trees in past timber harvest programs as well as the removal of snags and logs to reduce forest fuels due to wildfire concerns."

Overall declines in late-successional forests have been substantial. Two studies have tried to determine the extent of these declines. Based on a comparison of 2,455 ground plots measured in 1991-1993 with data from a 1940s-era mapping project, Beardsley et al. (1999) estimated that old-growth forests declined from 45 percent of the landscape in the mixed conifer, true fir, and pine types to 11 percent of the landscape between 1945 and 1993. Considered alone, however, mixed-conifer old growth declined from 50 to 8 percent of the landscape, indicating that these forests have declined by approximately 84 percent

since 1945. Remaining old-growth was found to occur primarily on federal lands, reflecting the substantial degradation of private lands. The authors stated that by 1993:

> "Of the 4.8 million acres of mixed-conifer forests in the Sierra Nevada, 371 thousand acres (8 percent) were old-growth. Almost all the old-growth was in Federal ownership, mostly National Forests and National Parks. Surprisingly, most of the old-growth in National Forests was outside designated wildernesses. Less than 2 percent of the 3 million acres of privately owned coniferous forests was old-growth."

Beardsley et al. (1999) noted that though many stands fail to qualify as old-growth, they have one or more large trees. Presumably a portion of these stands provide potential resting and denning habitat for fishers. Even these stands, however, are highly limited. The study found only 8 percent of the landscape is occupied by stands with three or more trees greater than 102 cm (40 inches) DBH and only 21 percent of the landscape was found to have one or more trees greater than 102 cm DBH.

With similar results, Franklin (1996) compared the amount of late-successional forests (LS/OG Ranks 4 and 5) in national parks and national forests in the Sierra Nevada and found that in the former, high-quality late successional/old-growth forests occupy 67 percent of mixed conifer forests, compared to 12 percent in the latter, indicating an approximate decline of 82 percent due to logging in national forests. Further, much of the late-successional forest remaining on national forests has been degraded by some selective cutting, or is highly fragmented (Franklin and Fites-Kaufmann 1996).

Loss and degradation of late-successional forests have been particularly severe in the central and northern Sierra Nevada, where logging began early and there are extensive private land inholdings (Leiberg 1902, McKelvey and Johnston 1992, Beck and Gould 1992). The onset of the gold rush in 1849 and later completion of the Southern Pacific Railroad resulted in extensive cutting in the Tahoe-Truckee Basin and surrounding areas prior to 1900 (Leiberg 1902, McKelvey and Johnston 1992). Logging has remained intensive in the northern and central Sierra to the present with the largest volumes removed since World War II. Beesley (1996), for example, noted that:

> "As an example, between 1902 and 1940, the total timber harvested on the Eldorado National Forest was 148.9 million board feet. From 1941 to 1945 it totaled 175.4 million board feet, reflecting wartime demand. Between 1946 and 1956, the harvest total stood at 728.9 million board feet, meaning that in thirteen years more than twice as much timber was harvested on the Eldorado than in the preceding forty-three years."

Intensive logging on private lands has furthered loss and degradation of late-successional forests, particularly in the central and northern Sierra Nevada. In the fisher's historic range north of Yosemite National Park, approximately 38 percent of the land is in private ownership and is predominantly managed as industrial timberlands—a far larger proportion than in the southern Sierra, with only 10 percent in private ownership, with no lands managed strictly as industrial timberlands (Table 5).

Table 5. Data summarized from the PRIME California Inventory Data 1997.

Region	Counties Included	Timberland (acres)			
		Public	Industrial	Other Private	TOTAL
North of Yosemite NP	Amador, Calaveras, Tuolumne, Butte, El Dorado, Glenn, Nevada, Placer, Plumas, Sierra, Tehama, Yuba	2,972,000	1,051,000	837,000	4,860,000
South of Yosemite NP	Fresno, Tulare, Mariposa, Stanislaus	1,002,000	0	114,000	1,116,000
	TOTAL	**3,974,000**	**1,051,000**	**951,000**	**5,976,000**

Logging on private lands has resulted in almost complete loss of stands with late-successional characteristics. Bias and Gutierrez (1992), for example, found that private lands in an area of checkerboard ownership within the Eldorado National Forest were generally depauperate of large trees and snags and other characteristics typical of late-successional forests. Further, Beardsley et al. (1999) found that less than 9 percent of private forestlands in the Sierra Nevada have a mean stand diameter greater than 53 cm (21 inches) DBH and that less than 2 percent can be classified as old-growth. These findings indicate loss

and fragmentation of late-successional forests and suitable fisher habitat over a substantial portion of the fisher's range.

Logging of both private and federal lands in the Sierra Nevada has had a dramatic effect on fisher habitat, resulting in loss of most suitable habitat in the central and northern Sierra Nevada and contributing to the likely extirpation of the fisher from this portion of the range. For example, Bombay and Lipton (1994) determined that the Eldorado National Forest lacked sufficient habitat to create high-quality "fisher use areas" because of an over-abundance of "sparse and open stands" and lack of contiguous mature or late-successional stands. Most high-quality habitat was found to occur in patches smaller than 16 ha (40 acres). Bombay and Lipton (1994) concluded:

> "The current vegetation on the Eldorado National Forest appears to provide a limited number of areas which meet the model parameters for habitat to support a fisher reproductive unit. Given this analysis, it would appear that the Eldorado National Forest does not currently have sufficient amounts and distribution of continuous large trees, dense canopied forest to support a population of fisher across the forest."

Similarly, the Lassen National Forest Land Management Plan concluded that "based on existing information, we have limited suitable furbearer habitat on the Forest right now. Existing habitat is being fragmented by continued logging and, in most instances, no longer meets the medium habitat capability for marten and fisher," (USDA Lassen National Forest 1993). Based on similar intensity of logging, extent of private inholdings (e.g. Beck and Gould 1992, McKelvey and Johnson 1992), and probable absence of fishers (Zielinski et al. 1997b), it is likely that the Stanislaus, Tahoe, and Plumas National Forests also lack sufficient suitable habitat for the fisher.

Logging impacts on fisher habitat also have been severe in the southern Sierra Nevada, particularly since World War II. For example, annual timber production in Fresno County rose from roughly 37 million board feet in 1947 to a peak in 1975 of 136 million board feet, remaining high into the early 1990s (Bolsinger 1978). This logging, including extensive clearcutting in the 1980s, has resulted in loss of forests with late-successional characteristics, and has compounded a high degree of natural fragmentation (Zabel et al. 1992). Spencer et al. (2007 at p. 42) found that "highly suitable resting microhabitats appear to be relatively rare even within areas of predicted suitable habitat at the coarse scale" in the southern Sierra Nevada.

Zielinski et al. (2005a) examined changes in the distribution of Pacific fishers relative to changes in old-growth forest cover in the Sierra Nevada over the previous century. Alterations in mature forest cover were represented by the difference between the historical Weislander Vegetation Type Map Survey (1929 and 1934; published in 1946) and contemporary vegetation data from the Sierra Nevada Ecosystem Project (1996) (Figure 3). In 1945, old-growth (where >50 percent of cover was from mature trees) comprised half of the forested area in the Sierra Nevada, and young growth/old-growth (where 20-50 percent of cover was from mature trees) comprised 76 percent of the area. By 1996, only 3 percent of the forested area in the Sierra Nevada was highest-ranking late-successional old-growth, with 38 percent of the Sierra Nevada being low to high-quality late-successional old-growth. These changes were most evident in the portion of the Sierra Nevada north of Yosemite National Park, where the loss of mature and old-growth forest conditions has been greatest – and also the region from which the fisher has been extirpated. The authors note (at p. 1401) that fishers:

> "live in low productivity and highly seasonal environments, have relatively short gestations, long periods of lactation, long inter-birth intervals and large home range sizes… This suite of life history characteristics led them to be characterized as 'bet-hedgers' (along with wolverines), a group that is particularly vulnerable to habitat disturbance and adult mortality." Furthermore, "even among carnivores, which are particularly vulnerable to extinction among mammals,…fishers are especially vulnerable to local extirpation and our data support this conclusion."

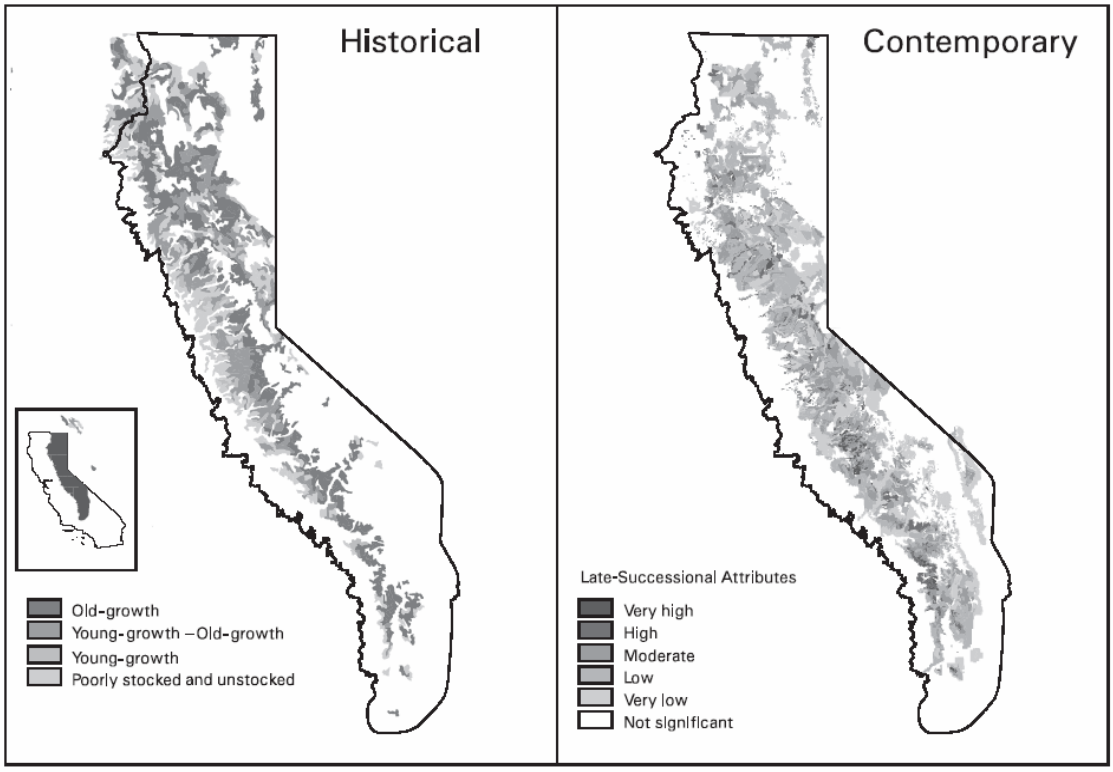

Figure 3. Maps of historical (Weislander Vegetation Type Survey, 1929 and 1934) and contemporary (Sierra Nevada Ecosystem Project, 1996) old-growth forest cover in the Sierra Nevada. From Zielinski et al 2006.

Changes in forest cover from logging and other anthropogenic activities not only directly impact fishers by eliminating the habitat elements needed for shelter, breeding, and foraging. Secondary, indirect impacts of logging include the creation of habitat conditions that favor generalist species such as gray fox and striped skunk (Campbell 2004). Campbell (2004) suggested (at p. 45) that habitat modification can facilitate access to habitat for generalist species that then displace or compete with the fisher, and that higher densities of these generalist species may ultimately hinder the recolonization of fishers into the northern Sierra Nevada.

Logging not only impacted fisher habitat historically, but remains a serious threat to the species to this day. For their petition to the U.S. Fish and Wildlife Service to list the Pacific fisher as an endangered or threatened species under the federal ESA, Greenwald et al. (2000) analyzed the impacts of logging on the fisher on national forest lands in the Sierra Nevada from 1993 to 1998. This analysis included projects proposed during the decade prior to the 2001 Sierra Nevada Forest Plan Amendment. Greenwald et al. (2000) reviewed Biological Evaluations (BEs), Environmental Assessments (EAs) and other decision documents for Forest Service projects where the agency concluded "may affect individual fishers, but is not likely to lead to a trend towards listing" from 1993 to July 1998. These documents were obtained through a Freedom of Information Act request that specifically asked for documents that determined potential effects to the California spotted owl for a particular time period, and thus the analysis only comprises a portion of those where effects on the fisher were determined. In addition, Greenwald et al. (2000) analyzed effects on the fisher of logging on private lands in the Sierra Nevada during the same time period by analyzing 204 timber planning documents from an area that is important for dispersal of fishers from the southern to the central and northern portions of the Sierra Nevada. These analyses indicate that logging on both Forest Service and private lands is having significant effects on this small and isolated population of the fisher:

Sequoia National Forest

Between 1993 and 1998, the Sequoia National Forest planned or carried out 20 projects, where the Forest biologist concluded that it "may affect the fisher, but will not likely lead to a trend towards Federal listing." Eighteen of these projects were timber sales. The other two were recreation related. Fishers were

detected in surveys or sighted within the vicinity of 14 of the projects. Timber sales in the 5-year period potentially affected 21,755 acres, or 2.4 percent of the forested area on the Sequoia National Forest, and removed up to 60.6 million board feet. Thinning and salvage were the most commonly utilized cutting methods. The former generally results in reduced canopy closure and ground disturbance, both harmful to fisher habitat, and the latter potentially removes structures used for resting and denning by the fisher. The two recreation projects included a trail plan for the entire forest and plans to construct the Sirretta Peak Trail. In the latter case, it was determined that the project would increase fragmentation, "affecting the normal travel patterns of fisher and marten."

Sierra National Forest

Between 1993 and 1998, the Sierra National Forest has planned or carried out 48 projects where the biological evaluation concluded "may affect individuals, but not likely lead to a trend towards Federal listing," or similar language. The majority of these were timber sales (28), followed by general projects (10), recreation (4), livestock grazing (3), prescribed burns (2), and roads (1). Fishers were sighted in the vicinity of five of the projects. Most were not specifically surveyed as part of the environmental review for the project, however. Timber sales potentially affected 27,026 acres and removed 107.3 million board feet. An additional 6,736 acres were affected by other projects. In total from 1993-1998, 3.9 percent of the forested area on the Sierra National Forest was impacted by these projects.

Cutting methods in the 28 timber sales included salvage, thinning, sanitation, shelterwood, and hazard tree removal. Most followed the Interim Guidelines to protect the California spotted owl. The Guidelines include prescriptions for previously established "spotted owl habitat areas," which protect 1,000 acre blocks of habitat around a portion of known owl sites; "protected activity centers," which protect 300 acres around most owl locations; and matrix lands. In matrix lands, two tiers of guidelines apply. In "select strata," which are stands preferentially selected by the owl for nesting, roosting or foraging, one entry for timber removal is allowed, but cutting is limited to trees <30 inches DBH and must retain ≥40 percent canopy closure, up to eight snags per acre ≥ 30 inches DBH or a snag basal area of 20 sq. ft/acre, 10-15 tons per acre of the largest downed logs, and 40 percent of the basal area in the largest live and cull trees. In "other strata," which also contains some stands used by the owl for nesting, roosting or foraging, the same guidelines apply, except canopy closure can be reduced below 40 percent and only 30 percent of the basal area must be retained in the largest trees. All, as evidenced by the determination of effects, removed or reduced components of high-quality fisher habitat, such as high canopy closure and multi-layered canopies.

The severity of effects on the fisher varied in the remaining projects. For example, general projects ranged from renovation of existing buildings, likely having a minimal effect on the fisher population, to three separate strychnine poisoning projects over thousands of acres, potentially resulting in loss of prey for or poisoning of fishers, which feed on pocket gophers and other rodents that may be poisoned (Zielinski et al. 1999). Similarly, recreation projects ranged from trail maintenance, in and of itself probably having little impact, to an OHV event, potentially affecting fishers through increased human activity and noise. The one new road that affected the fisher likely compounded habitat fragmentation from the existing system of roads on the Sierra National Forest.

Considering the small size and isolation of the fisher population (Truex et al. 1998), the negative effects of even one or a few projects should be cause for concern. Overall, the two national forests conducted or planned 68 projects in one five-year period that were considered to potentially negatively affect the fisher. Considered individually each project may not lead to a trend towards Federal listing. However, considered cumulatively and in the context of the considerable past habitat loss and fragmentation that has occurred on these forests, it is clear that this fragile fisher population and its habitat are being negatively affected, necessitating listing under CESA.

In addition, despite a prohibition on cutting trees >30 inches DBH enacted under the Interim Guidelines, a number of these sales cut larger trees that are used for resting and denning by the fisher. For example, the 10S18 Fuels Reduction Project, which was exempted from the Interim Guidelines as an administrative study, cut more than 300 trees >30 inches diameter. The recently proposed Kings River Project in the Southern Sierra Fisher Conservation Area is another example of a major logging project exempted from protective guidelines – in this case, the 2001 Sierra Nevada Forest Plan Amendment – under the guise of an administrative study.

Kings River Project

The massive administrative study known as the Kings River Project proposes timber harvest, herbicide treatments, and prescribed fire on 131,500 acres in the Dinky Creek and Big Creek watersheds of the Sierra National Forest over 25 years. The Forest Service recently approved Phase I, which authorizes logging of trees up to 30 inches DBH on more than 7,800 acres, including 5,000 acres of fisher habitat. The impacts analysis for the project assumed that suitable fisher habitat includes forests with canopy cover as low as 40 percent. The project proposes to eliminate dense forest cover on about 900 acres, despite research documenting that fishers select much higher levels of canopy cover (>60 percent but typically greater than 70 percent) at the microhabitat (Truex et al. 1998), home range (Zielinski et al. 2004b), and landscape scales (Carroll et al. 1999). In response to public outcry, the Forest Service's final decision proposed to retain 50 percent of the landscape outside the Wildland Urban Interface with a minimum of 60 percent canopy cover. However, this prescription is still inadequate to protect fishers, as female home ranges in the southern Sierra have a much larger proportion of the area (more than 70 percent) with >60 percent canopy cover. Spencer et al. (2007) explicitly stated:

> "The Kings River Administrative Project Area should be a focal area for increasing habitat value and contiguity. Fisher habitat between the Kings and San Joaquin Rivers is a relatively long and narrow stretch of variable but mostly moderate-quality habitat with rather tenuous potential as a source population area under current conditions…*Management should strive to increase the value, extent, and connectivity of fisher habitat between the Kings and San Joaquin Rivers.*" Emphasis in original.

Spencer et al. (2007) also note (at p. 42) that "further reductions or fragmentation of fisher habitat in this population segment may disrupt metapopulation dynamics sufficiently to increase extinction risks to the north and south…and consequently of the population as a whole." By eliminating the habitat needed by fishers to survive and reproduce, the Kings River Project as currently approved would seriously reduce the capability of the habitat to support fishers, in direct opposition to recommendations by premier fisher biologists.

Moreover, the project encompasses about 5 percent of the Southern Sierra Fisher Conservation Area that was designated for protection in the 2001 Sierra Nevada Forest Plan Amendment, indicating a failure of existing regulatory mechanisms to ensure a safety net for fishers. An estimated 36 individual fishers and portions of 13 fisher home ranges may occur within the project site. Given that fishers in the southern Sierra Nevada currently number between 100 and 500 animals, with potentially as few as 50 remaining females, this single major project is likely to contribute significantly to further population declines, and as such it poses a major threat to the continued persistence of the species in the southern Sierra Nevada. Fisher scientist Dr. Reginald Barrett stated in his expert declaration for an appeal of the Kings River project,

> "Lamberson 2000 notes that the loss of a few reproductive females could lead to a downward population spiral that culminates in extirpation. In my opinion, the proposed reductions in habitat quality in the Kings River Project could lead to such loss or, at a minimum, a reduction in reproductive success, which is key to fisher survival."

There is precious little 'wiggle room' for conducting experimental studies that eliminate and degrade critical fisher habitat in the southern Sierra Nevada because this population is extremely imperiled and reproductive rates in recent years have been perilously low (18 percent in 2003 and 36 percent in 2004 as reported by Dr. Barrett). Such large-scale degradation of fisher habitat in the Kings River Project also would adversely impact the fisher's ability to recover and recolonize. Notes Dr. Barrett, "the disappearance of fisher from the Kings River project area would create a bottleneck in the already imperiled Southern Sierra population similar to the central and northern Sierra bottleneck that has led to the fisher's current isolation and endangered status."

The Forest Service has justified the project's short-term adverse impacts on fisher by claiming that habitat will be 'protected' from fire in the long-term. However, the lack of scientific data supporting the need to remove medium and large-sized trees (i.e. $\geq$38 cm/15 inches DBH) for fire-risk reduction indicates that the Kings River Project would needlessly remove critical habitat elements required by fisher to persist in the area.

It is well-established that historic and recent logging has contributed to the extirpation of the Pacific fisher in the Sierra Nevada north of Yosemite National Park. Given the strong association of fishers with large trees and snags (Seglund 1995, Dark 1997, Truex et al. 1998, Campbell 2004, Zielinski et al. 2004a), the currently low numbers of such habitat elements across the landscape (Franklin and Fites-Kaufman 1996), and the high potential for extirpation of the fisher in the near future (Lamberson et al. 2000), administrative studies and other projects that remove substantial numbers of large trees, like the 10S18 Fuels Reduction project and the proposed Kings River Project, are likely to push the remnant highly imperiled population in the southern Sierra Nevada towards extinction. An administrative appeal of the Kings River Project by the Sierra Club, Sierra Forest Legacy, Earth Island Institute, and the California Native Plant Society was recently denied by the Forest Service and the project is being litigated.

In sum, logging projects that remove larger-sized trees, decrease canopy cover, and remove large snags on national forests in occupied Pacific fisher habitat continue to be proposed to this day and pose a major threat to the survival and recovery of the species.

Private Lands

More than 20 percent of lands north of Yosemite National Park are industrial timberlands, and overall nearly 40 percent are private lands subject to extensive anthropogenic changes (Table 5). South of Yosemite, about 11 percent of lands are in private ownership, although none are designated as industrial timberlands. Below, we describe results from recent research on timber harvest trends indicating continued extensive logging on private lands and a rise in the use of clearcutting as a silvicultural method, further exacerbating the ability of fisher populations to recover in the Sierra Nevada.

1. Assessment of Timber Harvest Plans in the Sierra Nevada, January 1999 to July 2002

The California spotted owl shares many of the habitat associations of the Pacific fisher. In the Sierra Nevada the California spotted owl occupies mixed conifer, red fir, ponderosa pine, and foothill riparian forests. Verner et al. (1992) calculated that 81.5 percent of owl territories were in mixed conifer, 9.7 percent in red fir, 6.7 percent in pine-oak, 1.6 percent in foothill riparian hardwood and 0.5 percent in eastside pine. Similarly, detections of fishers in the Sierra Nevada were most frequent in Sierran mixed conifer (46.4), followed by montane hardwood-conifer (18.8), montane hardwood types (11.6), red fir and Jeffrey pine (7.2 each), white fir (4.3), and montane riparian and ponderosa pine (1.4 each; Campbell 2004). Thus, there is overlap in forest types occupied by California spotted owls and Pacific fishers.

The majority of owls and fishers are found in Sierran mixed conifer forests, which occupy a mid-elevation belt on the west side of the Sierra Nevada, roughly 10-70, but mostly less than 30, miles wide and approximately 400 miles long. Britting (2002) conducted an analysis examining the intensity and extent of timber harvest on private lands within the summer range of spotted owl in the Sierra Nevada (using habitat information from California Wildlife Habitat Relationships 2002, version 7.0) from January 1999 to July 2002. Given the overlap of range and associated habitat types between fishers and spotted owls, the results of the analysis are pertinent to fishers – for currently occupied habitat in the southern Sierra Nevada as well as formerly occupied habitats in the central and northern Sierra Nevada that are critical for recovery of the fisher. The complete report is attached to this petition (Britting 2002) and the results are summarized below.

Data from the California Department of Forestry and Fire Protection (CDFFP) were used to complete an analysis of timber harvest proposed on private lands throughout the Sierra Nevada for the period January 1999 to July 2002. Britting (2002) reported that a total of 765 Timber Harvest Plans (THPs) occurred with the range of the California spotted owl for the period 1999 to 2001. Silvicultural treatments covered a total of 216,675 acres. Silvicultural prescriptions were grouped into three broad categories: even-aged, uneven-aged, or other. Even-aged includes clearcutting and similar methods such as shelterwood removal, shelterwood seed, seed tree removal, and seed tree seed. Uneven-aged management involves group selection (small clearcuts), selection, and transition, and "other" involves no-harvest on non-timberland, sanitation salvage, fuelbreak, rehabilitation, special treatment, right-of-way road construction, and commercial thinning. The California Forest Practice Rules (CFPR) directs the retention of trees in intermediate, uneven-aged, and some stages of even-aged prescriptions as described in Table 7.

Table 7. Retention levels required under the CFPR (CFPR 913.2, 933.2, 953.2, 913.3, 923.3, 953.3).

Silvicultural Method	Retention Required
Selection	75 to 125 sq. ft. basal area per acre depending on site class
Group selection	Groups from 0.2 to 2.5 acres and not covering more than 20% of a stand; 80% of stacked plots must meet 75 to 125 sq. ft. basal area / acre depending on site class
Commercial Thinning	50 to 125 sq. ft. basal area per acre depending on site class and forest type; or where dominant canopy in trees 14" DBH or less 75 to 100 trees per acre depending on site class
Shelterwood Seed Step	Retain at least 16 trees 18" DBH or greater and trees over 24" DBH count as two trees; 50 to 125 sq. ft. basal area / acre depending on site class
Seed Tree Step	Retain at least 8 trees 18" DBH or greater and trees over 24" DBH count as two trees

Britting (2002) reported that of the total acreage submitted for THPs in the study area during from 1999 to mid-2002, 41.3 percent was subjected to even-aged management and 38.7 percent to uneven-aged management. The remaining 20 percent was treated by other prescriptions (Table 8). Thus, the majority of private timberlands in the Sierra Nevada were subjected to clearcutting or similar silvicultural prescriptions.

Table 8. Acreage of each prescription group included in THPs within the range of CSO in the Sierra Nevada between 1999 and 2002. Prescription groupings are as outlined in Table 15.

YEAR	EVEN-AGED (AC)	UNEVEN-AGED (AC)	OTHER (AC)	TOTAL (AC)
1999	35,171	41,334	18,214	94,719
2000	27,894	20,366	10,058	58,318
2001	24,254	18,572	12,386	55,212
2002 (as of 6/25)	2,191	3,676	2,559	8,426
Total	**89,510**	**83,948**	**43,217**	**216,675**

A total of 487 different landowners submitted THPs. Of these, approximately 76 percent of the acres to be harvested were owned by just 13 parties. The five parties submitting the greatest number of acres to be treated accounted for over 54 percent of the acres to be treated in this period. Sierra Pacific Industries (SPI), the major private landowner in the Sierra Nevada, submitted THPs covering 68,960 acres for the period 1999 to mid-2002 (Table 9). This amounts to about 31 percent of all the acres in the THPs submitted in the Sierra Nevada.

Table 9. Comparison of Sierra Pacific Industries THP submission to all THPs submitted within the range of CSO in the Sierra Nevada.

OWNER	EVEN-AGED (AC)	UNEVEN-AGED (AC)	OTHER (AC)	TOTAL (AC)
SPI	41,630	9,790	17,544	68,960
All others	47,880	74,158	25,673	147,715
Total	**89,510**	**83,948**	**43,217**	**216,675**

THPs for the period 1999 to mid-2002 affected between 6 and 13 percent of the private coniferous forest land per county (Table 10). For counties within the current distribution of the fisher, 11,141 acres were treated on private lands during the time period. Italicized counties include those within the current distribution of the fisher in the Sierra Nevada.

Table 10. Distribution of acreage in THPs by county. County data from PRIME California Inventory Data 1997. Italicized counties are within the currently occupied range of the Pacific fisher.

County	Forest Industry	Other	Total Private	Total treated acres 1999 to 2002	% treated in 42 months
Amador	27,000	34,000	61,000	6,487	11
Butte	153,000	76,000	229,000	18,548	8
Calaveras	53,000	83,000	136,000	8,318	6
El Dorado	120,000	131,000	251,000	16,956	7
Fresno and Madera	0	60,000	60,000	*7,817*	13
Lassen	281,000	63,000	344,000	26,612	8
Mariposa	0	31,000	31,000	*1,946*	6
Nevada	36,000	163,000	199,000	17,225	9
Placer	69,000	93,000	162,000	10,228	6
Plumas	216,000	100,000	316,000	25,438	8
Shasta	527,000	175,000	702,000	34,975	5
Sierra	63,000	48,000	111,000	12,687	11
Tehama	196,000	9,000	205,000	18,369	9
Tulare and Kings	0	23,000	23,000	*1,378*	6
Tuolumne	66,000	51,000	117,000	6,714	6
Yuba	34,000	42,000	76,000	5,782	8
TOTAL	**1,841,000**	**1,182,000**	**3,023,000**	**219,480**	**7**

2. Regional analysis of the Sierra Nevada's Southern Forest District 1990 to 2003

For a petition to the U.S. Fish and Wildlife Service to list the California spotted owl as a threatened or endangered species under the federal ESA, Greenwald and Thomas (2004) examined the intensity, type, and extent of THPs proposed in the 'Southern Forest District,' a region extending from El Dorado County in the north to San Bernardino County in the south and covering 11 counties. This regional analysis uses the geographic information system (GIS) database of timber harvest plans (THPs) created by the California Department of Forestry and Fire Protection (CDFFP) for the Southern Forest District (CDFFP 2003 and 2004) for the period 1992 to mid-2003.

Private timberland in the 11 counties in the Southern Forest District represented in the database covers approximately 3.0 million acres (PRIME Timber Inventory 1999). Approximately 367,082 acres or 12 percent of this area has been harvested in a 12-year period from 1992 to 2003 (Tables 11 and 22). A number of management approaches are used in this landscape. Using the prescription classes defined above, Table 11 below displays the distribution of acres to be harvested. The acreage of uneven-aged management peaked in 1996 and has dropped since that time (Figure 4). Meanwhile, since 1999 there has been an increase in even-aged management in this region. This management class now generally exceeds all other types (Britting 2002).

Table 11. Acreage identified in THPs from 1990 to 2003 in the Southern Forest District.

Year	Alternative	Even-aged	Other	Uneven	TOTAL
1992	7,882	1,305	5,340	15,655	30,181
1993	4,772	2,828	12,368	22,397	42,365
1994	4,632	3,995	5,978	26,402	41,007
1995	6,607	4,079	5,330	22,159	38,175
1996	6,389	16,544	17,300	27,165	67,397
1997	1,987	5,757	7,675	16,137	31,556
1998	1,089	7,265	5,252	11,150	24,757
1999	1,143	10,327	3,156	8,405	23,030
2000	1,913	4,221	1,889	3,801	11,824
2001	5,008	3,823	3,100	5,650	17,581
2002	4,276	8,535	3,086	5,164	21,061
2003	3,807	7,263	3,494	3,583	18,148
TOTAL	**49505**	**75,941**	**73,968**	**167,667**	**367,082**

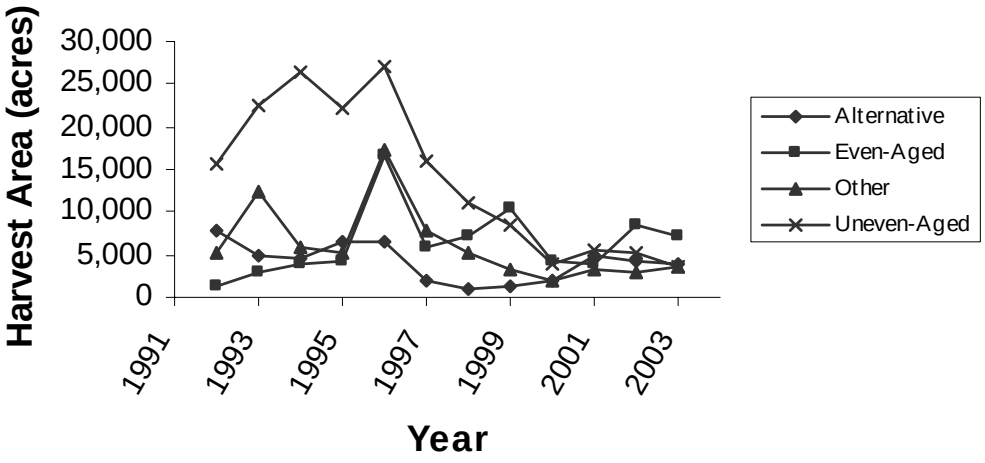

Figure 4. Trend of silvicultural prescription types used on private lands in the Southern Forest District of the Sierra Nevada from 1992 to 2003. Data values from Table 11 above.

Throughout the Southern Forest District and during this time period over 1,000 different land owners submitted THPs. Most of these THPs were small and less than 1,000 acres in size. Overall, five industrial land owners dominated the submissions of THPs and accounted for about 66 percent of the area proposed for harvest (Table 12).

Table 12. Distribution of area proposed for harvest by land owner.

Landowner	Harvested Area (Ac)	Proportion of Total (%)
Sierra Pacific Industries	130,365	36
Georgia Pacific	58,650	16
Westsel-Oviatt Lumber Company	21,744	6
Southern California Edison	21,720	6
Fiberboard Corporation	11,342	3
Other owners	123,261	34
TOTAL	**367,082**	**100**

From 1992 to 2003, the CDFFP accepted THPs covering 367,082 acres in the Southern Forest District. There are approximately 3.0 million acres of private forest lands within the 11 counties for which THPs were submitted. Thus, about 12 percent of the private coniferous forests on private lands were harvested during this period.

Comparing these estimates of harvest with the regional values for the period 1992 to 2003 indicates that specific regions in the Sierra Nevada are being harvested at a much greater rate than indicated by forest district values. There are approximately 95,016 acres of private land in the regional analysis area. The THPs submitted for the period 1992 to 2003 covered 36,082 acres or about 39 percent of the private land in the regional analysis area. Thus, some regions of the Sierra Nevada may be experiencing harvest rates that are several times greater than the mean rate for the Sierra Nevada. Pacific fishers in these areas will be disproportionately affected by the existing THP regulations which do not adequately protect the species.

In the Southern Forest District regional analysis for the period 1992 to 2003, even-aged management covered 14 percent of the private land in the analysis area. Even more disturbing, the use of even-aged management has been increasing since 1996. Even-aged prescriptions Sierra-wide during the period 1999 to mid-2002 covered the greatest number of acres (Table 8). Sierra Pacific Industries (SPI), the major private forest landowner in the Sierra Nevada, accounted for about 31 percent of the acreage submitted under THPs in the Sierra Nevada between 1999 and mid-2002, and prescriptions utilized by SPI are dominated by even-aged management and in particular clearcutting. Considering the pace and scale of timber harvest recently completed by SPI and proposed in their long-term planning documents (Sierra Pacific Industries 1999), it can be reasonably predicted that even-aged harvest, with a particular emphasis on clearcutting, will be applied to the majority of the actively managed timberlands in the Sierra Nevada. Thus, in the near future, privately owned coniferous forests are likely to be dominated by stands less than 30 years old, with few large and very large live trees, little structure heterogeneity, and few large snags and logs. These areas will not provide suitable habitat for fisher.

3. Logging on Private Inholdings in the Stanislaus National Forest from 1990-1998

Because of large private land inholdings, the northwest portion of the Stanislaus National Forest was identified as an Area of Concern (AOC) for the California spotted owl (Beck and Gould 1992). This AOC is within the historic range of the fisher, and although currently unoccupied, it is situated in a region that would be important to the northward dispersal of fishers. To assess the type of harvest activity occurring in an area dominated by private lands important to fisher dispersal, Greenwald et al. (2000) examined timber planning documents prepared from 1990-1998 on five sites within this AOC. Sites were 8,000-acre circles where any timber planning document that had some or all cutting units within the circle were analyzed.

For the nine-year period monitored, 204 timber harvest planning documents were filed, for a total of 938,294 acres treated. Twenty-seven of these documents (18,572 acres) were filed as emergencies primarily for the removal of insect damaged trees, and 109 documents (881,595 acres) were filed as exemptions primarily to treat dead, dying, or deteriorating trees. THPs were filed in 68 instances covering 37,947 acres. The number of THPs and exemptions filed and their respective acreage varied somewhat by

year for the period 1990 to 1998 (Table 13). The patterns suggest that harvest operations were not declining over this period and appear to be somewhat stable with a slight increase after 1995.

Table 13. Harvest documents proposing activity within five 8,000-acre regions in the northwest quarter of the Stanislaus National Forest.

Year	Number of THPs	THP acreage	Number of Exemptions	Exemption Acreage	Number of Emergencies	Emergency Acreage
1990	5	3,125	14	110,894	17	11,662
1991	8	4,926	12	91,434	5	14,520
1992	6	2,255	12	12,272	0	0
1993	5	2,876	7	45,874	2	1,800
1994	7	2,753	13	74,486	0	0
1995	6	4,272	13	73,692	0	0
1996	14	7,992	15	190,087	0	0
1997	8	4,998	13	125,929	1	60
1998	6	4,750	8	104,952	2	710
TOTAL	**68**	**37,947**	**109**	**881,595**	**27**	**18,572**

In many cases, THPs were proposed in the same area as exemptions for the period between 1990 and 1999. An estimate of the total number of THPs that occurred within areas that had come under exemptions for the period of review is difficult to determine, nevertheless the following example illustrates the pattern. Exemptions were filed four times on the same 39,000-acre area each year from 1993 to 1996. During this same period and in this same area, 12 THPs totaling 7,161 acres were filed. The harvest activities associated with these timber harvests removed habitat elements (i.e. large trees, large snags, multi-layered canopies) required to maintain fisher habitat. Despite the magnitude of effects to fishers, the impacts of these logging activities on the fisher or its habitat are not disclosed or mitigated in the harvest documents.

Since the required documentation for emergencies and exemptions is limited to a one to two page application, the detailed review from Greenwald et al. (2000) focused on the more extensive information provided in the 68 THPs. The vast majority of the THPs were submitted by industrial forest operations (61 THPs covering 37,457 acres). As can be seen in Table 13 above, the number of acres harvested in THPs has increased somewhat from 1990 to 1999. Importantly, the type of prescription used most frequently over that period also has changed. Early in this period, clearcutting was used occasionally, whereas after 1995, this prescription became dominant in the THPs reviewed. This pattern also is reflected in statistics gathered from THPs throughout the entire Sierra Nevada for the period 1994 to 1999. Between 1994 and 1999, there was a seven-fold increase in acres harvested with a clearcut prescription on private timberlands in the Sierra Nevada (Table 14).

Table 14. Data reported from California Department of Forestry.

Prescription	Acres Harvested					
	1994	**1995**	**1996**	**1997**	**1998**	**1999**
Clearcut	1,197	577	3,673	2,042	4,785	8,600
Other prescriptions	40,181	33,548	60,725	27,822	18,519	13,982
Clearcut as a Proportion of Total Acres Harvested	2.9	1.7	5.7	6.8	20.5	38.0
Total Number of THPs	221	206	223	146	140	110

None of the THPs reviewed by Greenwald et al. (2000) identified the cumulative effects of the numerous timber sales occurring in and around each of the five areas. Further, of the 68 THPs, only four

mention the presence of late successional forests in the analysis area, and none identify impacts to late successional forests. Three of the THPs identify that fishers were sighted in the area in 1965, but no additional mitigation measures for this species or others associated with late-successional forests were identified.

In sum, past and ongoing timber practices on private lands have resulted in a highly fragmented landscape with heavily thinned forest having few trees over 54 cm (21 inches) DBH, further fragmented by large gaps in forested vegetation created by even-aged management. This vegetation pattern is more extensive north of Yosemite National Park, presenting a serious challenge to fisher dispersal from the populations in the southern Sierra Nevada northward.

b. Northern California

Logging in northern California on both private and federal lands has resulted in substantial loss and fragmentation of late successional forests and fisher habitat. The continued persistence of fishers in northwestern California may be due to sprouting ability of the evergreen hardwoods and redwoods that flourish in this region, enabling the forest canopy to recover after logging more rapidly than in other parts of the fisher's range in California (Carroll et al. 1999). However, although fishers persist in northern California in greater numbers than elsewhere on the West Coast, there is evidence that logging has resulted in reduced fisher densities (Truex et al. 1998).

The current northern California range of the fisher includes four national forests—the Six Rivers, Mendocino, Klamath and Shasta-Trinity—found in six counties (Del Norte, Humboldt, Mendocino, Siskiyou, Shasta, and Trinity Counties). Roughly 80 percent of the forested area in the three coastal counties (Del Norte, Humboldt, and Mendocino) is privately owned, including large tracts of industrial timberlands (Waddell and Bassett 1996). In contrast, a majority (about 62 percent) of the forested area in the interior counties is publicly owned (Waddell and Bassett 1997).

Logging in northern California has been a mix of clearcutting and selective methods. Clearcutting is the predominant method in moister coastal and more northerly forests, but has occurred in all areas. Regardless of method, however, logging in northern California has resulted in substantial loss of late-successional forests and high-quality fisher habitat.

Bolsinger and Waddell (1993) estimated there are roughly 668,250 acres of old-growth on federal lands in northern California or roughly 14.9 percent of the forest acres. Considering that old-growth may have occupied as much as 70 percent of the landscape prior to European settlement (USDI 1990), this indicates old-growth in northern California may have declined by as much as 79 percent on federal lands in northern California. Similarly, Morrison et al. (1991) estimated there were 798,300 acres of old-growth on the western portions of the Klamath and Shasta-Trinity National Forests, and all of the Six Rivers National Forest. In contrast, FEMAT (1993) estimated that there are 1,470,800 acres of multi-storied stands with trees over 54 cm (21 inches) DBH, which they characterized as late-successional, on federal lands in northern California, equal to roughly 32.8 percent of federal lands. Although not characterized as old-growth by Bolsinger and Waddell (1993), some of the additional acres identified by FEMAT (1993) probably provide habitat for the fisher. However, more than half of these acres occur at elevations greater than 1,200 m, indicating a much smaller proportion of the landscape within the elevational range utilized by the fisher supports late-successional forests as defined by FEMAT (1993). In addition, according to FEMAT (1993) "late-successional / old-growth forests" on federal lands are "typically highly fragmented by harvested areas and stands of younger trees." Fragmentation likely makes many old-growth forest stands unavailable to the fisher because of its aversion to crossing areas of little forest cover (Rosenberg and Raphael 1986, Powell 1993).

On private lands in northern California, most stands are even-aged and less than 100 years old (Waddell and Bassett 1996, 1997). Bolsinger and Waddell (1993) estimated there were only roughly 780,800 acres of old-growth on private lands in the north coast and north interior resource areas of California, a portion of which is outside the present range of the fisher. This amounts to roughly 15.7 percent of private lands in these areas (Waddell and Bassett 1996, 1997). Many of these stands, however, have been entered for harvest (Bolsinger and Waddell 1993). Bolsinger and Waddell (1993), for example, concluded that:

> "On private lands, most of the 1,423,000 acres classified as old-growth [in Washington, Oregon and northern California] consist of stands from which old trees have been removed. Mixed-conifer stands in California make up the bulk of these forests. They have been selectively logged one to several times over the past century, but they still contain three of the four major elements of the ecological definition of old-growth forest—mature or overmature trees, multilayered canopy with several age groups represented, and snags and coarse woody material on the ground."

The proportion of these stands that provide high-quality habitat for the fisher is unknown. However, remaining old-growth on private lands is probably even more fragmented than on federal lands. FEMAT (1993), for example, concluded:

> "Late-successional/old-growth stands that remain on private and state lands tend to typically occur in small patches surrounded by cutover areas and young stands."

Carroll et al. (1999) documented gaps in fisher distribution within a 67,000-km^2 study area in the Klamath region of northwestern California and southwestern Oregon and adjacent portions of the northern California coast. The authors expressed concern (at p. 1357) that "land-use strategies that incorporate short timber harvest rotations may isolate remnant areas of fisher habitat," a trend that is particularly troubling in the coastal region which is largely in private ownership. Moreover, little low-elevation forest is contained within existing protected areas, thus conservation of the fisher will depend on multi-ownership cooperative management at the regional scale (Carroll et al. 1999). Unfortunately, forest practices rules governing logging on private lands are grossly inadequate to protect fisher habitat.

Loss, degradation, and fragmentation of late successional forests because of clearcutting and selective logging in northern California have resulted in substantial loss of fisher habitat with likely negative effects on the fisher. Although studies on the direct effects of logging on the fisher in northern California are limited, information in both Buck et al. (1994) and Truex et al. (1998) indicate that loss of habitat because of logging has affected the fisher population in northern California. Buck et al. (1994), in a study comparing the fisher's use of adjacent lightly and heavily harvested areas in northern California, found that fishers were more selective in the heavily harvested area, avoiding areas where most of the conifer overstory had been removed. They further speculated that by reducing the quantity and distribution of highly suitable habitat, logging may force fishers into sub-optimal habitat, ultimately increasing fisher mortality and lowering reproduction, concluding:

> "If timber management practices create timber-types that are sub-optimal, then survival and reproduction of fishers should decrease within these timber types. Some evidence supports this hypothesis: 7 radio-collared fishers died during our study—2 adult males, 1 adult female and 4 juveniles. All were recovered in habitats considered sub-optimal by our analysis: clear-cuts, areas without overhead canopy cover, and hardwood dominated stands."

Similarly, Truex et al. (1998) found that fisher densities were lower and home ranges larger in their Eastern Klamath Study Area than in their North Coast Study Area and speculated that this was because of observed "poorer habitat quality" on the former due to extensive clearcutting, concluding:

> "A number of independent indices of forest structure, habitat use, and demography suggest that the eastern Klamath population occurs in poorer habitat and may be more characteristic of 'sink' habitat than either of the other study areas."

Both of these studies suggest that reductions in the quantity and quality of fisher habitat because of logging in northern California have reduced fisher density and survivorship. The negative effects of logging on fisher populations in northern California continue to the present day.

Similar to the Sierra and Sequoia National Forests in the Sierra Nevada, Greenwald et al. (2000) quantified effects of logging and other projects on the fisher on the Klamath, Six Rivers, Shasta-Trinity and Mendocino National Forests by requesting and reviewing all Biological Evaluations (BEs), Environmental Assessments (EAs) and other decision documents for projects where the agency concluded "may affect individual fishers, but is not likely to lead to a trend towards listing," since the Northwest Forest Plan was enacted in 1994 until 1998. Documents were obtained through the Freedom of Information Act.

Klamath National Forest

Between 1994 and 1998, the Klamath National Forest planned or carried out 52 projects where a biological evaluation concluded that the project "may affect" individual fishers, including 32 timber sales, 8 general projects, 3 prescribed burns, and 3 road, 3 mining, and 3 recreation projects. Fishers were sighted, found in surveys, or occurred in a historical record in the vicinity of 23 of these projects. Most projects were not surveyed for fishers, however.

Timber sales potentially affected at least 23,177 acres and removed at least 70 million board feet. Salvage logging was the most commonly identified prescription (18), followed by thinning (15), sanitation (5), shelterwood (5), overstory removal (2), group selection (2), and clearcutting (2). All of these prescriptions potentially led to removal of structures associated with high-quality fisher habitat, such as canopy cover and large snags, trees, and logs.

Five of the eight general projects were gopher poisoning, which, as mentioned previously, could lead to poisoning of fishers. Other general projects included forest clearing for a powerline, watershed restoration, and forest disease control. Road projects included reconstruction of a road and various road maintenance tasks. Mining projects included permits for two separate mines and drilling of exploratory wells. Recreation projects included construction of a corral and trail maintenance.

Mendocino National Forest

From the time the Northwest Forest Plan was enacted until 1998, the Mendocino National Forest planned or carried out 31 projects that may have affected individual fishers, including 21 timber sales, 5 general projects, 4 recreation projects and 1 burn. Surveys for fishers were not conducted in association with these projects, but fishers were sighted in the vicinity of seven of the projects.

Salvage was the most commonly identified prescription for timber sales (10), followed by thinning (3) and shelterwood (1). Greenwald et al. (2000) lacked information on prescription for a number of sales because they only received biological evaluations and not environmental assessments, which are generally more detailed. Timber sales potentially affected at least 8,622 acres and removed at least 51.3 million board feet.

General projects, which included tree planting and wildlife habitat enhancement, probably had fairly minor effects. The two road projects were both permits for hauling timber and the four recreation projects were all OHV events. Both timber hauling and OHVs have the potential to disturb fishers.

Shasta-Trinity National Forest

Between 1994 and 1998, the Shasta-Trinity National Forest conducted 23 projects where it was determined that they "may affect" individual fishers, and 13 where it was determined that they will "likely" affect individual fishers, but not lead to a trend towards federal listing. Timber sales accounted for 32 of the projects, with 2 general projects and 2 road projects accounting for the remainder. Fishers were sighted in the vicinity of 12 of the projects with most of the remainder not surveyed.

Timber sales potentially affected at least 30,900 acres and removed at least 51.9 million board feet. Salvage and hazard tree logging were by far the most commonly identified prescriptions (25), followed by thinning (8), sanitation (5), overstory removal (3), group selection (1), and clearcutting (2). As noted previously, all of these prescriptions can result in the removal or degradation of fisher habitat.

The two general projects consisted of construction of a phone line and a land exchange, and the two road projects consisted of a maintenance project and a programmatic evaluation of road use permits, with varying effects on the fisher.

Six Rivers National Forest

Between 1994 and 1998, the Six Rivers National Forest conducted 36 projects where it was concluded in a biological evaluation that the project "may affect" the fisher, including 17 timber sales, 11 road projects, 5 prescribed burns, 2 general projects and 1 recreation project. Fishers had been recorded in surveys or sighted in the vicinity of at least 18 of these projects.

Timber sales potentially affected at least 11,152 acres and removed 37.7 million board feet. The most commonly identified prescription was thinning (10), followed by salvage (6), clearcutting (3) and

shelterwood (1). Clearcutting probably produced the most volume, as the Pilot Creek Ecosystem Management Project, which included clearcutting, was expected to remove roughly 15 million board feet alone. Seven fishers, some known to have reproduced, were found in this timber sale's project area.

Road projects consisted of both maintenance and construction and likely contributed to habitat fragmentation for the fisher. The effects of the five prescribed burns on the fisher are unknown at this time. The two general projects consisted of construction of a fireline and a lookout tower. Construction of a trail and maintenance of a campground was the one recreation project.

In sum, from 1994 to 1998, the four national forests planned or conducted 155 projects where it was determined that fishers may be affected. These determinations were made by qualified biologists who were required to visit the project sites before making their determination. Considered alone, any one of these projects might not lead to a trend towards federal listing. Considered cumulatively and in the context of considerable past habitat loss and degradation, however, it is clear that Forest Service projects potentially had a substantial impact on fisher habitat. Significantly, this analysis did not consider the numerous timber sales and other projects occurring on private lands in northern California.

A majority of "may affect" determinations (105 of 159; 66 percent) resulted from timber sales with salvage logging being the most commonly identified prescription. This is of concern because salvage logging removes large snags and logs used by the fisher for resting and denning and because requirements for "green tree retention" under the Northwest Forest Plan do not apply to salvage sales. Other prescriptions, such as thinning, clearcutting, overstory removal, and shelterwood, have also led to loss of fisher habitat.

A number of more recent timber sales (since 2000) have been proposed on the four national forests in the range of the Pacific fisher in northern California. Table 15 below provides a partial list of these proposed logging projects that originally targeted large trees for harvest on a combined total of ≥67,888 acres. Many of these sales harvested large trees in late successional reserves. We gathered this information from the Forest Service's online Schedules of Proposed Actions. Table 15 only includes a portion of projects proposed because many of the older SOPA lists were currently unavailable online, and in some cases acreages of projects were not included in the SOPA list and thus were not included in our tally. Moreover, many smaller sales that likely removed larger trees were listed as Categorically Excluded (CE) and the SOPA list provided no acreages for these sales. Several of the larger timber sales were cancelled after objection by conservation groups, or are currently being opposed in court, while some have been implemented or are in the early planning stages. However, as Table 15 demonstrates, the push by the Forest Service to implement timber harvest projects that target larger-sized trees continues to threaten remaining habitat for the imperiled population of fishers in northwestern California, and clearly indicates that existing regulations are failing to adequately protect fisher habitat.

Table 15. Partial list of major timber sales on four national forests within the range of the Pacific fisher in northern California, 2000-2007. Acreage includes estimate of old-growth forest.

TIMBER SALE	ACREAGE	TIMBER SALE	ACREAGE
SHASTA-TRINITY NATIONAL FOREST		**KLAMATH NATIONAL FOREST**	
Upper Dubakella	1,000	Knob	578
East Fork	2,077	Meteor	912
East Fork II	1,000	Elk Thin	388
Beegum Corral Regan	2,400	HCFP03	100
Beegum Rock	490	Jack Conventional	677
Lower Hayfork	1,298	Beaver Creek	975
Browns	787	Horse Heli	1,680
Eagle Ranch	264	Uptown	760
North Whitney	280	Westpoint	1,026
Slate Thin	360	Whittler	760
New River	4,630	Erickson Thin	2,556
Clear Creek	1,980	Five Points	1,701
Hemlock	4,725	**SIX RIVERS NATIONAL FOREST**	
Edson	290	Journey Fire Salvage	97
Powder	2,934	Deadwood	340

Pilgrim	3,780	Hazel	800
Ten Flat Thin	261	Weaver	920
Gemmill	1,700	Dome (LSR)	153
Jones Thin	540	Sims Fire Salvage	169
Algoma	4,700	Orleans	2,721
Mudflow	3,000	Big Flat	1,000
Porcupine	4,300	Little Doe/Low Gulch	923
Pettijohn	780	Megram Fire Salvage Phase I	1,118
East Fork Texas Spider	2,000	**MENDOCINO NATIONAL FOREST**	
		Cold Chimney/Spanish/Ocean	706
		Divide Auger	327
		Blands	925
	TOTAL		**67,888**

The environmental analyses for many of these projects demonstrate the inadequacy of current protections for fisher on national forest lands in northern California. The March 2006 Environmental Assessment for the 2,934-acre Powder Vegetation and Fuels Management Project in the Shasta-McCloud Management Unit of the Shasta-Trinity National Forest provides a good example of the lack of consideration for fisher habitat on the individual project level, especially for cumulative impacts on fisher habitat in the region. The administrative appeal of the Powder project by the Klamath Forest Alliance and Conservation Congress noted that fisher were documented in the Shasta-McCloud Management Unit by the Forest Service's Redwood Sciences Lab, and on surrounding private lands on the McCloud Flats and in the Sacramento River Canyon Area. However, no specific surveys for fishers were conducted on the Powder project site, and no mention was made of fishers in the Environmental Assessment (the EA simply discussed "carnivores"). Moreover, as the appeal noted, there had been a major increase in the number of acres proposed for thinning down to 40 percent canopy cover on national forest land between the Goosenest Ranger District and Shasta-McCloud Management Unit, including such projects as Davis, Hemlock, Edson, Mountain Thin, Little Horse Salvage, Tennant WUI, Tamarack, Pomeroy, and Erickson Thin, totaling more than 50,000 acres. This was not considered in the environmental analyses. The Forest Service's decision on the Powder project was overturned in court. Since that time, an additional sale in the Shasta-McCloud Management Unit, the 3,780-ac Pilgrim Vegetation Management Project, was approved in June 2007. This project would harvest old-growth trees on a 415-acre unit and depart from the Shasta-Trinity Forest Plan's green-tree retention standard of leaving the largest and oldest trees on 15 percent of the area (Pilgrim EA at pp. 2-3). The U.S. Fish and Wildlife Service had determined that the project would have an adverse effect on designated spotted owl critical habitat (owls occupy relatively similar habitats as the fisher), nonetheless the project was approved.

These projects, together with logging on adjacent private lands, fragment the landscape and reduce the ability of the fisher to persist and recover. Carroll et al. (1999 at p. 1357) noted that "[m]aintaining viable and well-distributed fisher populations may require increased levels of canopy closure and retention of large hardwoods on managed lands." Clearly, without vigilant oversight by conservation groups, fragmentation and degradation of fisher habitat would be substantially worse. However, forcing private citizens to provide continued oversight of poorly planned logging projects is not an adequate safety net for fishers, as there are no assurances that conservation groups will continue to watchdog Forest Service projects in the future.

In conclusion, logging has resulted in substantial historical loss of fisher habitat on both public and private lands throughout the Sierra Nevada and northern California and continues to present a major threat to the continued existence of the species.

II. Roads

Roads also have significant effects on fisher habitat. Roads result in the loss and fragmentation of habitat, create barriers to fisher dispersal, cause death directly through vehicular collisions, and allow access to poachers and legal trappers who may incidentally capture and kill fisher (Freel 1991, Dark 1997, Witmer et al. 1998, Wisdom et al. 2000). Areas with higher road densities have also been found to support lower densities of large trees, snags, and downed logs than areas with fewer roads because of the access

provided for fuelwood cutting and logging (Quigley and Arbelbide 1997). Campbell (2004) found that sample units with track stations where fishers were detected had significantly fewer roads than unoccupied units in the Sierra Nevada. Campbell (2004) also found that "at coarser spatial scales, sample units within the fisher region were negatively associated with precipitation, road density and habitat variability." This result indicates that fishers are associated with lower-elevation areas of contiguous forested habitat with fewer roads.

The fisher's historic range in California – particularly in the northern Sierra Nevada – is heavily dissected by roads. In the Sierra Nevada, a total of 25,000 miles of road have been constructed on public lands alone (USDA 2001). Similarly, a total of 109,443 miles of road have been constructed in Oregon, Washington, and northern California on federal lands in the range of the northern spotted owl (FEMAT 1993). Countless more roads have been constructed on private lands. Numerous large state and interstate highways create barriers for the fisher, limiting recovery and isolating existing populations. For example, all of the known fisher locations in the Sierra Nevada occur south of the southernmost of four major highways that cross the range (Zielinski et al. 1997a). These highways probably contributed to declines of the fisher in the central and northern Sierra and are likely a barrier to reconnecting the southern Sierra and northern California populations. In a review of issues related to the conservation of the fisher in the Interior Columbia Basin, Witmer et al. (1998) concluded:

> "Barriers to movement may include large nonforested openings and highways. Maintenance of links between individuals and populations will require elimination or reduction of these barriers."

However, no plans have been proposed to facilitate fisher dispersal across the four major highways that cross the species' Sierra range. Mortality associated with roads poses a serious threat to small fisher populations, especially in the southern Sierra. Indeed, at least eight fishers were documented as killed by vehicles in California in the mid-1990s (Chow personal communication, Zielinski et al. 1995a, Truex et al. 1998), and one Forest Service Biologist (S. Anderson) reported that road-killed fishers are "relatively common" in the Sequoia National Forest (Zielinski et al. 1995a). Campbell et al. (2000) concluded:

> "Loss of individuals from a small isolated population may hasten decline. Of particular concern are collisions between fisher and vehicles. Many records of fisher locations are in the form of roadkills."

Truex et al. (1998) recommended that increases in paved roads or vehicle speed should be discouraged in areas managed for fishers. Increase in road densities throughout the Sierra Nevada resulting from urban development, logging, and recreation in fisher habitat is likely to exacerbate this problem.

III. Urban Development

Development of private lands is a threat to the fisher throughout its range, having much the same effect on habitat as does logging. McBride et al. (1996) measured forest conditions in both developed and undeveloped areas in various forest types of the Sierra Nevada, including red fir-lodgepole pine, mixed conifer, ponderosa pine, and foothill woodland. The authors found that in all forest types human settlement reduced tree canopy cover and density, stating:

> "Construction of structures, roads, and other infrastructure elements in forests often necessitates the removal of trees and results in reduction of canopy cover and tree density. Trees may also be removed to facilitate access to sunlight, especially in more densely wooded areas. Conversion of tree cover to lawn also contributes to the decrease in tree canopy cover and density."

Average canopy cover in mixed conifer was 92 percent in control areas compared to 64 percent in developed areas (McBride et al. 1996). Similarly, in ponderosa pine, average canopy cover was 90 percent in control areas compared to 62 percent in developed areas. The more concentrated the development the greater the proportion of converted land. McBride et al. (1996) found that in areas where lots were one acre, a greater proportion (41 percent) of the surface area was covered by impervious materials, such as structures and roads, than in either the three to five acre or 10 to 20 acre lot sizes. These larger lot sizes both had approximately 7.5 percent of the area covered by impervious material. Thus, as with logging, development reduces the density and cover of forests, and when combined with the disturbance from noise, traffic and other human activities, is counter to maintaining fisher habitat.

Population growth has been dramatic in California and is predicted to continue. The human population of the Sierra Nevada, for example, doubled from 1970 to 1990 and is approximately four times the peak populations of the gold rush (1849-1852) (Duane 1996a). Further, the population is predicted to triple from 1990 levels by 2040. Development in California is resulting in direct conversion of forest land in the historic range of the fisher (Table 16).

Table 16. Loss of productive forest land to roads, and agricultural and urban development on private lands in the California range of the Pacific fisher.

Area	Acres of forest converted to:			Total (acres)	Period	Source
	Roads	Agriculture	Urban			
Northern and central Sierra	7,000			7,000	1984-1994	Waddell and Bassett 1997a
N. Coast California	17,000	9,000	21,000	47,000	1984-1994	Waddell and Bassett 1996
N. Interior California	8,000			8,000	1984-1994	Waddell and Bassett 1997b

Throughout the entire range of the Pacific fisher in the United States, Bolsinger and Waddell (1993), estimate that productive forest lands declined by three million acres from 1930 to 1992 in California, Oregon, and Washington and concluded that "the major causes of the decrease in forest area were construction of roads, reservoirs, powerlines and clearing for urban expansion and agriculture."

In the 1980s alone, losses of forest area in Washington were nearly 300,000 acres, mostly in western Washington (Maclean et al. 1992, McKay et al. 1995). In western Oregon, 247,000 acres of forest were lost between 1961 and 1986 (MacLean 1990) and the north coast area of California lost 47,000 acres of forest between 1984 and 1994. These statistics only consider forested lands that were directly converted to another use, such as a house or a road. Numerous other areas have been invaded by dispersed development. Bolsinger et al. (1997) estimated that a total 424,000 acres of large, contiguous blocks of forest, which they termed "primary forest," were lost in Washington State between 1980-1991, mostly in western Washington. We lack similar estimates for recent loss of primary forest in California, but given the extent of population growth here, losses are probably on the same order as in Washington.

Zielinski et al. (2005a) correlated changes in fisher distribution in the Sierra Nevada in relation to changes in human density as represented by United States census maps of housing density from 1930 to 1990 (Figure 5). The authors noted (at p. 1403) that the fisher:

> "occurs at a relatively low elevation which puts it in closer proximity to human activities than the congeneric marten. Interestingly, the gap in the fisher historical distribution aligns well with the area of greatest increase in human influence… In these areas, homes are built in fisher habitat, roads are more common, the forests around the built environment developments are managed to reduce forest density, and there is long history of private land management for timber (compared with public land managed for multiple uses). These factors probably conspire to render home range areas less suitable, leading to the contraction of the range in this area."

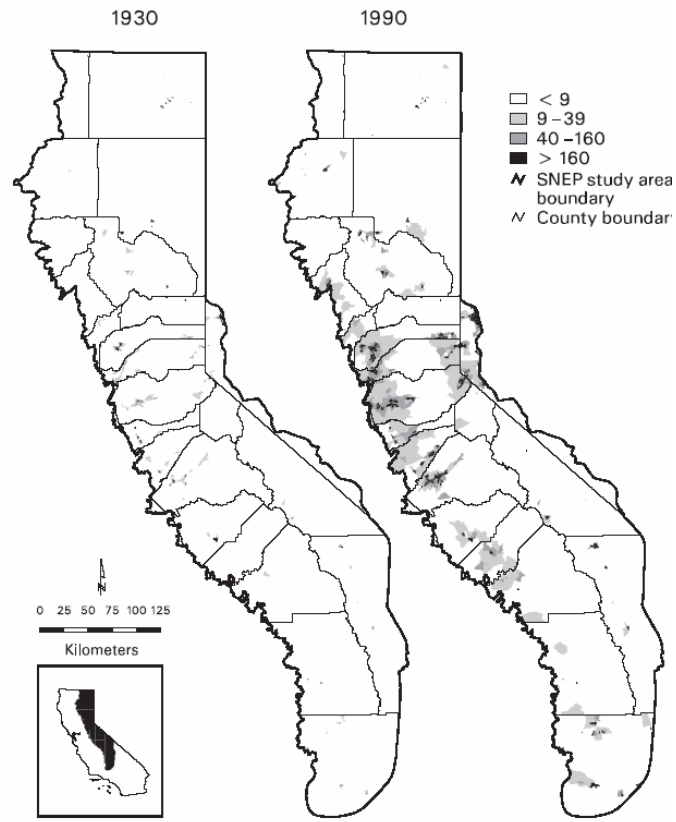

Figure 5. Housing densities per square mile in 1930 and 1990 for the Sierra Nevada from U.S. Census Bureau data. From Zielinski et al. (2005a).

The increase in roads and infrastructures such as water tanks that occur with urban development is likely to have significant impacts on the extremely small population of fishers in the southern Sierra Nevada. At least nine fishers have been documented as being trapped and killed in water tanks in recent years, and numerous fishers have been killed by vehicles. Specific protections to reduce fisher mortalities in urban areas where fishers occur are needed as part of a comprehensive recovery plan—measures that would be possible with a listing of the fisher under CESA.

IV. Recreation

Recreation can affect fishers negatively through noise and direct disturbance by people. If such disturbance occurs regularly on particular trails or roads it can result in loss and fragmentation of habitat. Loss of habitat also can occur from construction of infrastructure for recreation, for example, roads or ski slopes. In a review of the effects of proposed management on forest carnivores in the Sierra Nevada, Campbell et al. (2000) provided the following summary of the potential effects of recreation:

> "That recreational activities can have substantial impacts on wildlife species is widely acknowledged, but this relationship is poorly understood... Recreation activities can alter behavior, cause displacement from preferred habitat, and decrease reproductive success and individual vigor. Peak recreation levels often coincide with the most critical phases of the species life cycle such as during breeding and reproduction. Flight from human presence and interruption of behavior increases energetic costs experienced by an individual."

Recreational use and impacts are particularly intense in the southern Sierra. Duane (1996b) estimated that in 1996 there were 50 to 60 million "recreation visitor days" (RVDs) per year in the Sierra Nevada, of which two thirds occur on national forest lands. These RVDs were concentrated in the southern Sierra with potentially negative consequences for the existing fisher population. Duane (1996b) stated:

> "The Inyo, Sequoia and Sierra National Forests—each of which is adjacent to at least one of the national parks in the southern and central Sierra Nevada—account for 45% of all RVDs on the USFS lands in the Sierra Nevada. Together with the national parks, this portion of the Sierra Nevada probably represents one of the highest levels of recreational activity in the entire world."

Considering that the population of California is expected to double or even triple by 2040 (Duane 1996a), recreational activities are likely to also grow, resulting in further loss of habitat and disturbance to the fisher. Duane (1996b) noted that just because population doubles or triples does not necessarily mean there will be twice as many RVDs, but also concluded:

> "Even without a proportionate doubling of demand, however, conflicts are likely to increase between recreational activities and other uses of public lands and resources."

Substantial recreational use also occurs in other portions of the Pacific fisher's range on both national park and national forest lands. Redwood, Sequoia, Kings Canyon, and Yosemite National Parks are all in the range of the fisher and all receive significant numbers of visitors (Table 17). The effects of recreation on the fisher or its habitat in these national parks have not been explored. However, well-used roads and trails in these parks have probably resulted in some level of habitat fragmentation and probably impede fisher movement and dispersal.

Table 17. Number of visitors to national parks in the California range of the fisher in 1999.

National Park	Visitors
Sequoia	873,229
Kings Canyon	559,534
Yosemite	3,493,607
Redwood	369,726

The types of recreation allowed in national forests have the potential to do more harm to fishers than in national parks. Activities, such as OHV races, which are not allowed in national parks, have a greater likelihood of resulting in disturbance to the fisher. The amount of development in support of recreation is also potentially greater on national forests, including construction of ski slopes and RV campgrounds.

V. Poaching and Incidental Capture

Trapping of fishers for their fur was one of the primary causes of the decline of the species across the United States in the first half of the twentieth century (e.g. Powell 1993). Many studies of fisher demography involve populations that have been subjected to trapping mortality (see citations in Powell and Zielinski 1994). Trapping is a critical factor influencing fisher demography, "replac[ing] natural population fluctuations with fluctuations caused by periods of overtrapping followed by recovery when trapping pressure decreases," (Powell and Zielinski at p. 44). In response to concern over severe declines in number of fishers caught, legal trapping of fishers was prohibited in California in 1946 (Lewis and Zielinski 1996). Poaching and incidental capture and injury, however, remain threats to the fisher.

Lewis and Zielinski (1996) report that trappers and California Department of Fish and Game biologists had information demonstrating recent occurrence of poaching and illegal sale of pelts. Fishers are easily caught in traps set for other furbearers, such as fox or bobcat (Powell and Zielinski 1994). Lewis and Zielinski (1996) estimated an incidental capture of 1 fisher per 407 set-nights and a mortality-injury rate of 0-75 percent, based on data from trappers. Poaching or incidental capture can potentially affect fisher populations, even if it is a relatively rare occurrence. Powell (1979) predicted that mortality of as few as 1-4 fishers per 100 km^2 was sufficient to result in decline of a population in the Midwest. An increasing number of trapping licenses sold in California in the late 1970s and early 1980s may have resulted in more incidental fisher captures, particularly considering that trappers can cover much larger areas and have greater access to remote areas due to an increase in roads. Lewis and Zielinski (1996) added:

> "The magnitude of the effect of additive mortality would depend on the sex and age of the captured individuals (Krohn et al. 1994), and may be greater in western populations since they have not demonstrated the rapid population recovery after protection that has been observed in eastern populations…[T]he potential effects of legal trapping of other species on protected fisher populations

should not be ignored, especially when considered in conjunction with habitat loss…and other sources of mortality (e.g., road-kills)."

California has recently banned leg-hold traps and snares by citizen initiative, which should help reduce risk of fisher injury or mortality with incidental capture. USDA and USDI (1994) recommended closing all national forests in the range of the northern spotted owl to trapping for American marten because of similarity of appearance of martens and fishers, but this was not ultimately adopted in the Record of Decision for the Northwest Forest Plan.

VII. Natural Events

a. Predation

Predation appears to be an important source of mortality for the fisher (Buck et al. 1994, Truex et al. 1998). On the Hoopa reservation in 2007, 3 of 12 denning females were killed by predators (Coastal Martes Working Group notes; 14 June 2007). Of 16 known mortalities recorded by Truex et al. (1998), from radio-collared animals, nine were suspected to have resulted from predation. Similarly, Buck et al. (1994) documented that four of seven mortalities in northern California resulted from predation. Potential predators include other carnivores, such as mountain lion, bobcat, and coyote, and large raptors, such as golden eagle, great horned owl, or northern goshawk (Powell 1993, Powell and Zielinski 1994, Truex et al. 1998). Truex et al. (1998), for example, documented several mortalities, including suspected predation from coyotes in two cases, one mountain lion, and an unidentified raptor. Bobcats are a significant predator of fishers on the Hoopa reservation (Coastal Martes Working Group notes; 14 June 2007). The fisher may be more susceptible to predation in areas with less forest cover and thus logging may expose them to additional risk (Buck et al. 1994).

b. Forest Fire

It is widely recognized that many western forest types historically were influenced by frequent fires, including ponderosa pine and mixed conifer forests of the Sierra Nevada and Klamath/Siskiyou Region, and that loss of fire from these systems because of livestock grazing, fire suppression, and other factors combined with intensive, widespread logging has resulted in changes to forest structure (Agee 1993, Covington and Moore 1994, Kilgore and Taylor 1979, Swetnam and Baison 1994, Swetnam et al. 2000, Quigley and Arbelbide 1997, Weatherspoon et al. 1992). Very large areas burned by crown fires may pose a risk to existing fisher territories and habitat, although this issue needs further research.

Creating a quandary for land managers, solutions to the problems of increased fuel loadings and likelihood of crown fire, such as prescribed fire and thinning, also pose some risk to fisher habitat. For example, large trees and snags required for resting and denning by fishers, which are already at low levels in the Sierra Nevada (Franklin and Fites-Kaufman 1996), could potentially be further reduced by fuels treatments.

While experts have suggested that there may be a risk that fisher territories and habitat can be altered by crown fire, late-successional, mixed conifer forests where the fisher is generally found are at lower risk of crown fire than other seral-stages and forest types. High canopy closure, which keeps fuels moist, and large trees, which are generally fire resistant, make late-successional, mixed conifer forests less likely to burn at high severities. Weatherspoon et al. (1992), for example, state:

> "Countryman's (1955) description of fuel conditions within old-growth stands applies in large measure to fuel conditions within many mixed conifer stands used by the California spotted owl. These stands are less flammable under most conditions, because the dense canopies maintain higher relative humidities within the stands and reduce heating and drying of surface fuels by solar radiation and wind."

Although the above quote is specifically discussing risk to the owl, the same conclusions can be drawn for the fisher because it uses similar habitat. USDA (2000), in a discussion of fire risk in the Sierra Nevada, determined that only 5 percent of areas designated as "old forest emphasis areas" were categorized as having the highest fire hazard and risk, compared to 25 percent for the Sierra Nevada as a whole. The document concludes:

> "The highest hazard and risk areas were often adjacent to (rather than within) patches of old forests, California spotted owl PACs, and critical aquatic refuges."

In addition, the fisher's aversion to human activity and high-use roads (Dark 1997) means they are less likely to occur in areas where human-caused fires would be most frequent.

All of these factors indicate that a cautious approach to fuels treatments should be taken that does not compromise fisher habitat in the short-term in order to save it from an unknown risk presented by future catastrophic fire. Such an approach should focus on prescribed fire and limited thinning of small trees in areas of highest risk.

Moreover, there are likely to be some benefits to fishers from fire, possibly even higher severity fire. For example, management of fisher habitat, particularly in the southern Sierra Nevada population, must involve consideration of hardwoods, as research has indicated that hardwoods comprise a significant proportion of resting sites and hardwood habitat types likely provide key habitat for prey species. Zielinski et al. (2004a) noted that black oaks – which are particularly important for fishers – regenerate best in open conditions after a disturbance, and appear to have declined due to fire exclusion.

A multi-party effort including scientists, stakeholders, and government agencies are working on an assessment of the southern Sierra fisher population and how this population might respond to fire and timber harvest. As part of this effort, the Conservation Biology Institute was contracted by Region 5 of the Forest Service to model how probability of occupancy might be affected either by 'similar to historic' or 'higher than historic' future fire regimes, as well as by alternative forest management prescriptions to reduce fire risk. A progress report was released in December 2007. Information within the report should prove useful for determining whether and how to appropriately manage fisher habitat from a fire-risk perspective. However, any conservation recommendations within the assessment would not be mandatory nor would it address the myriad other impacts to fishers throughout California. Thus the development of this document nor of any other voluntary conservation plan does not supplant the need for listing the fisher under CESA.

c. Population Size and Isolation

Independent of any anthropogenic factors, fisher populations may be at risk of extinction solely because of isolation and small population size, particularly the southern Sierra population (Truex et al. 1998, Campbell et al. 2000, Lamberson et al. 2000, Spencer et al. 2007). Small, isolated populations are at risk of extirpation because of demographic and environmental stochasticity and inbreeding depression and Allee effects.[1] Inbreeding significantly decreases time to extinction for small populations (Brook et al. 2002). These factors can lead to irreversible population crashes (e.g. Hanski and Moilanen 1996). Campbell et al. (2000), for example, concluded:

> "Low population densities combined with low reproductive rates and relatively high individual longevity hampers recovery from impacts and retards the ability to recolonize areas from which they have been extirpated, even in the presence of suitable habitat."

The southern Sierra fisher population probably numbers fewer than 300 total individuals and fewer than 120 adult females (Spencer et al. 2007). The northern California population is estimated to number <750 individuals (Nichols 2006). The very small size of both of these populations places them at great risk of extinction from declines related to demographic and environmental stochasticity such as fluctuations in gender ratio or climatic events that result in reduced prey abundance or poor fisher survival (Pimm et al. 1988). Such risk is increased by the isolation of these populations, which ensures that when population declines occur there will be no immigration to rescue the populations. Isolation also places the two California populations at significant risk from inbreeding depression. Indeed, Drew et al. (2003) and Wisely et al. (2004) have already determined that remaining populations in California have lower genetic diversity compared to Pacific fisher populations in British Columbia. Finally, as a top-level predator, fishers naturally occur at low densities. This makes them inherently more vulnerable to extinction because as populations decline due to habitat loss and other factors, Allee effects become ever more likely (Pimm et al. 1988).

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[1] The Allee effect is the phenomenon that for smaller populations, reproduction of individuals decreases. This effect usually disappears as populations get larger.

Wisely et al. (2004 at p. 646) noted that "the magnitude of genetic structure and lack of gene flow we found was unexpected given the relatively recent colonization of the peninsula and the fisher's large spatial requirements and long dispersal distances." Apparently, human-induced fragmentation of once relatively contiguous forest habitats increased the genetic isolation of California's remaining populations in recent times. The authors further stated that:

> "[e]rosion of remaining genetic diversity threatens these populations with inbreeding, inbreeding depression, and a reduced ability to adapt to changing environments…Of equal concern is the demographic fate of these isolated populations. Populations in the south have a smaller effective population size than northern populations. Small population size coupled with low migration rates increase vulnerability to stochastic demographic events and environmental changes. We have demonstrated isolation among populations with limited exchange, suggesting that populations on the Pacific coast have little demographic buffer from variation in the population growth rate."

Spencer et al. (2007) concluded that:

> "Populations persistence is less dependent on the total number of individuals than on the effective population size (N_e; Wright 1931). Effective population size is a measure of the rate at which genetic variation changes over time. It is inversely proportional to a population's probability of extinction, and is smaller than actual population size due to effects of population fluctuations, uneven sex ratios, age-structuring of populations, and other factors. Genetic work should therefore be used to determine N_e of the southern Sierra Nevada fisher population and its potential for future population growth. Recent genetic work on fishers suggests that this population is genetically depauperate (Wisely et al. 2004), meaning that N_e will probably be quite low (W. Zielinski, personal communication). *If effective population size is below about 50, extinction is probable over a relative short term, and population augmentation may be warranted*." Emphasis in original.

d. Disease

Relatively little is known about diseases in fishers (Brown et al. 2006). Brown et al. (2006) report that pathogens causing potentially severe disease in closely related species of Mustelidae include rabies virus, canine distemper virus, parvoviruses, influenza viruses, corona viruses, *Brucella* spp. (cause of brucellosis), *Yersinia perstis* (cause of the plague), *Leptospira interrogans* (cause of leptospirosis), *Toxoplasma gondii* (cause of toxoplasmosis), *Dioctophyma renale* (giant kidney worm), and *Trichinella spiralis* (cause of trichinosis). Moreover, canine adenovirus (cause of canine infectious hepatitis) has killed striped skunks and members of the Canidae.

Of 28 fishers sampled from several locations in Canada, Philippa et al. (2004) found that four fishers had antibodies for canine adenovirus; four for canine coronavirus; four for parainfluenza virus type 3; four for rabies virus; and 18 had antibodies for *Toxoplasma gondii*. In a study of 31 wild-caught fishers on the Hoopa reservation in northwestern California, Brown et al. (2006) found that one fisher tested positive for canine distemper virus and 11 fishers tested positive for canine parvovirus. Canine parvovirus causes diarrhea with blood or mucus, fever, and dehydration, and would be most severe in young animals. Canine distemper virus causes respiratory disease, immunosuppression, neurological disease, and death (Brown et al. 2006). The source of these viruses is unknown, but the authors speculate that gray foxes or other carnivores as well as domestic unvaccinated dogs may be local reservoirs for these diseases. If dogs are a virus source, Brown et al. (2006 at p. 44) point out that "fishers living near humans are likely to be exposed to the virus more often than fishers with home ranges farther from human habitation." Moreover, the authors state that "both CDV and CPV have the potential to cause immunosuppression, especially of young animals, and to work synergistically with other pathogens to increase morbidity or mortality in a susceptible population." Disease issues should be a concern with potential relocation of fishers into areas from which they have been extirpated but might come into contact with extant populations (Brown et al. 2006).

INADEQUACY OF EXISTING REGULATORY MECHANISMS

> "Establishing the reasons for the precarious status of the fisher populations in the Pacific Northwest may not be as important in the short term as making people aware of the status and providing federal protection for the populations. ***That the populations appear dangerously low should be sufficient to generate protection; discussions and research into the reasons should occur after protection***. In our opinion, protection by the states of Washington, Oregon and California has not been sufficient to improve population status." (Powell and Zielinski 1994; emphasis added)

Widespread logging, road building, and development in California's forests over the last century and a half have severely depleted important components of Pacific fisher habitat, such as large trees, snags and downed logs, and multi-layered dense canopies, resulting in drastic declines and fragmentation of habitat and contributing to the extirpation or severe reduction of fishers from the northern and central Sierra Nevada and in northern California. Logging, road building, and urban development continue to affect the fisher negatively to the present day. Existing and proposed regulations on public and private lands fail to adequately protect the remaining two small, isolated fisher populations from further declines. Current multi-agency efforts to develop conservation plans for the Pacific fisher (in the southern Sierra and the West Coast) are helpful but would be entirely voluntary, and thus would not provide the legal safety net or assurances that protective measures are implemented as would a listing under CESA. Thus voluntary conservation plans can be a supplement to, but not a replacement for, legal requirements to conserve the Pacific fisher under the Endangered Species Act.

Existing regulations designed to protect the fisher and associated late-successional forests on public lands in the Sierra Nevada consist of 'furbearer networks' designated on some of the Sierra Nevada national forests, and consideration for fishers under forest plan standards and guidelines that were adopted in the 2004 Sierra Nevada Forest Plan Amendment. The Giant Sequoia Management Plan also provides regulations that impact fisher habitat on public lands in the southern Sierra. On northern California's public lands, the Northwest Forest Plan provides regulations designed to protect fisher habitat on Forest Service and Bureau of Land Management lands. The California Forest Practices Rules govern timber management practices on private lands, and various state agencies are responsible for public road building and maintenance, and permitting development on private lands. Below, we discuss current and proposed regulations in relation to their ability to safeguard the existing Pacific fisher population in California by maintaining existing habitat as well as to facilitate the recolonization of the fisher back into a larger portion of their historic range, including the central and northern Sierra Nevada.

I. Forest Service Regulations

a. California-wide

National Forest Management Act Planning Regulations

Congress enacted the National Forest Management Act of 1976 ("NFMA") to reform Forest Service management of national forest system lands. 16 U.S.C. § 1600 *et seq*. The NFMA requires that the Forest Service implement a Land and Resource Management Plan ("LRMP") for each national forest. The forest planning process must comply with the National Environmental Policy Act ("NEPA") which requires the preparation of an environmental impact statement with public review and input. 42 U.S.C. § 4231 *et seq*. The LRMP must include land allocations, desired conditions, objectives, and standards and guidelines with which site-specific projects must comply. In addition, among NFMA's substantive requirements is the duty to provide for the diversity of plant and animal communities. 16 U.S.C. § 1604(g)(3)(B). In 1982, the Forest Service adopted implementing regulations for the NFMA, including a provision that "[f]ish and wildlife habitat shall be managed to maintain viable populations of existing native and desired nonnative vertebrate species in the planning area." 36 C.F.R. § 219.19(a)(1) & (6)(1982). To facilitate this provision, the Forest Service is required to select, monitor, and maintain habitat for management indicator species.

Both NEPA and NFMA make small steps towards offering protection for sensitive species, but neither law provides the strong, definitive conservation measures of either the federal ESA or CESA, and as such neither is adequate to conserve the highly imperiled Pacific fisher. The NEPA requires federal agencies, including the Forest Service and the Bureau of Land Management, to consider the effects of their

actions on the environment, including sensitive species. However, it does not prohibit them from choosing alternatives that will negatively affect individual fishers. The NFMA regulations require species viability, but do not prohibit the Forest Service from carrying out actions that harm species or their habitat, stating only that "where appropriate, measures to mitigate adverse effects shall be prescribed." 36 C.F.R. § 219.19(a)(1). By contrast, CESA § 2053 states "it is the policy of the state that state agencies should not approve projects as proposed which would jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species, if there are reasonable and prudent alternatives available consistent with conserving the species or its habitat which would prevent jeopardy." Moreover, the CESA prohibits any person from taking or attempting to take (i.e., hunt, pursue, catch, capture, or kill) species listed as endangered or threatened, or any such species that is a candidate for listing under CESA. The provisions of CESA provide much stronger protection for the fisher than under NEPA and NFMA alone.

Within the past few years, the Forest Service under the Bush Administration began to weaken the NFMA planning regulations and to exclude the public from the forest planning process. In 2005, the Forest Service published a rule stating that the 1982 planning regulations were no longer in effect and determined that the forest planning process would not require NEPA analysis or an environmental impact statement. The agency also determined that its 2005 rule did not require consultation with the U.S. Fish and Wildlife Service to assess impacts of the new planning regulations on threatened and endangered species. Importantly for fishers and other wildlife, the 2005 rule also eliminated the specific species viability and diversity requirements, and required forest management plans to provide only for a diversity of ecosystems. 36 C.F.R. § 219.10(b) (2005). In March 2007, a federal court in the northern district of California enjoined the Forest Service from implementing the 2005 rule; in August 2007, the Forest Service again released a proposed rule that is virtually identical to the currently enjoined 2005 rule, eliminating the species viability requirement. Fed. Reg. Vol. 72, No 163, Thursday August 23, 2007 at p. 48515. In the most recent proposed rule, the Forest Service claimed that ensuring species viability is "not always possible" for the following reasons: (1) distribution patterns or population declines are sometimes due to factors outside the agency's control; (2) the number of vertebrate species present is "very large;" and (3) focus on the viability requirement has "often diverted attention and resources away from an ecosystem approach to land management that, in the Agency's view, is the most efficient and effective way to manage for the broadest range of species with the limited resources available for the task." *Id.* at p. 48522. The Forest Service provides no examples of when and how the viability requirement has diverted attention from an ecosystem approach, nor does it provide any examples of the agency being blamed for any species declines not resulting from management activities on national forests. While it may be inconvenient for the Forest Service that national forests support a large number of vertebrate species, this is not a legitimate reason for removing the requirement to monitor them when implementing projects that may cause potential harm. Simply put, the Forest Service has not focused sufficient attention on monitoring the effects of their management activities on vertebrate populations on national forests, and it is clear from recent actions that the agency has no intention of attempting to change their modus operandi. The effort to eliminate the species viability and diversity requirements is a case in point as to the Forest Service's lack of commitment to adhere to its own long-standing regulations to protect fishers and other sensitive species of plants and animals from potentially harmful management activities.

To make matters worse, the Forest Service is now chipping away at many of the other protections for the fisher provided by the NFMA and existing planning regulations. First, the agency is proposing to eliminate the fisher as a management indicator species on six national forests in California. Second, the standards and guidelines protecting fishers in the 2001 Sierra Nevada Forest Plan Amendment were drastically weakened in a 2004 overhaul of the Amendment. One reason given for the 2004 SNFPA overhaul is that the fisher is already protected by furbearer networks, or 'Habitat Management Areas,' yet most LRMPs do not provide specific protective measures within HMAs. Third, the Forest Service recently eliminated the 'Survey and Manage' program under the Northwest Forest Plan that indirectly provided some habitat protection for the fisher in northern California. Finally, the Giant Sequoia Monument management plan – which was recently declared illegal in court – failed to provide basic protections for much of the remaining occupied fisher habitat in the southern Sierra Nevada, where the species is clinging to existence. Below, we discuss each of these issues in turn.

Management Indicator Species Amendment

An important tool for measuring impacts of the Forest Service's management projects on wildlife is the designation, monitoring, and maintenance of habitat for "management indicator species" (MIS). As part of each national forest's Land and Resource Management Plan developed under the 1982 implementing regulations for NFMA, the Forest Service is required to monitor habitat and population trends of MIS, as well as to maintain and improve their habitats. The species are selected because changes in their populations indicate the effects of management activities on a host of other species dependent upon similar habitat types – in other words, MIS are monitored as proxies for the broader array of species inhabiting similar habitats. Both the 2001 and revised 2004 Frameworks required that the Forest Service monitor effects of projects on long-term viability of MIS, and to maintain and improve the habitats they depend upon for survival. Monitoring is absolutely critical to determining whether fisher populations are responding positively or negatively to management activities on national forest system lands.

In the Sierra Nevada, the Pacific fisher is currently a designated MIS on the Inyo, Lassen, Sierra, Stanislaus, and Tahoe national forests. On the Inyo, the fisher is a MIS for habitat; on the Lassen and Sierra, it is a MIS for both habitat and population trends, and on the Stanislaus and Tahoe, it is a MIS for population trends. Of these national forests, the Pacific fisher currently occupies only the Sierra National Forest, but the other national forests are part of the species' former range and are critical for its recovery. In northern California, the fisher was listed as a MIS on the Klamath National Forest. In the past few years, the Forest Service has proposed removing the Pacific fisher and many other species from the list of MIS to reduce the agency's monitoring requirements. In September 2004, the Klamath National Forest issued an Environmental Analysis ("EA") proposing to amend its forest plan to eliminate the Pacific fisher and other species as MIS, reducing the list of 32 MIS to just four species, including three tree species and only one animal species (the northern spotted owl). Although the EA (at p. 10) notes that the Pacific fisher was originally designated as a MIS because "the fisher is a good indicator of habitat quality because it is habitat specific, especially in its denning and resting needs," the EA then fails to offer any discussion or analysis as to why the fisher was eliminated from the MIS list. The Klamath National Forest's amendment process is currently on hold.

Similarly, in February 2007, the Forest Service released a draft Environmental Impact Statement proposing to slash the list of MIS on all national forests in the Sierra Nevada. The proposed action would eliminate the Pacific fisher as a MIS on the Inyo, Lassen, Sierra, Stanislaus, and Tahoe national forests because, due to the species' "limited distribution in the Sierra Nevada, population trend data are unlikely to provide useful information to inform forest service management at the Sierra Nevada scale." DEIS at p. 94; Appendix B. However, the distribution of the fisher is limited only because it has been extirpated by human activities from the northern and central Sierra Nevada. It should be presumed that the limited distribution is a temporary state and that the recovery of the fisher would include expansion of the population back into its historic range. Monitoring of habitat conditions and assessing impacts of site-specific projects on potential fisher habitat throughout the entire historic range is critical to ensure that there is sufficient suitable habitat to allow for fishers to recolonize the central and northern Sierra – particularly if reintroduction efforts are to proceed and succeed. That said, the Forest Service eliminated the fisher as a MIS even on the Sierra National Forest where the species is still present. The proposed action would eliminate any legal requirement for the Forest Service to conduct ongoing monitoring of fisher habitat and populations as part of forest plan implementation to determine impacts of projects on currently occupied habitat and potential habitat for recolonization and recovery.

The DEIS proposes to designate three species as MIS for late-successional forests: the California spotted owl, the northern flying squirrel (*Glaucomys saubrina*), and the American marten. While there is some overlap in habitat use among these species, the fisher occurs in lower-elevation forests than the flying squirrel and American marten, putting the fisher into "closer proximity to human activities than the congeneric marten," (Zielinski et al. 2004a at p. 1402). The Sierra Nevada Forest Plan Accomplishment Monitoring Report for 2005 reports that "fishers were consistently detected at lower elevations than martens. Fishers were detected as low as 3,110 feet and as high as 9,000 feet; martens detections ranged from 4,400 feet to 9,793 feet." Thus, a large portion of lower-elevation habitat for fishers is not represented by maintaining habitat for marten. Moreover, while the California spotted owl also shares many habitat associations as the Pacific fisher, the owl is less impacted by barriers such as large roads. Campbell (2004) found that low density of roads is a significant variable differentiating areas occupied and

unoccupied by fishers. Thus, the impacts of some projects likely might differ between the two species, and maintenance of fisher habitat may include different considerations than spotted owl habitat. In sum, retaining the fisher as a MIS is the best means to ensure continued monitoring and reporting of population status and habitat conditions for this habitat specialist.

The DEIS also expresses the Forest Service's desire to create a uniform list of MIS applicable across the Sierra Nevada. While there is value to including as MIS some species that currently occur throughout the entire mountain range, there is also value to including species that are important indicators of the health of sensitive habitats within some, but not all, of the national forests. The mountain range is not uniform from north to south, and thus there is no legitimate reason why the MIS list should be uniform.

The Forest Service's DEIS attempts to reassure the public that the fisher would not be impacted by its removal from the MIS list, stating (at p. 33) "for those at-risk species with existing monitoring programs, such as the California spotted owl and Pacific fisher, those monitoring programs will remain in place even if those species are no longer designated as MIS. For Forest Service Sensitive Species, monitoring, analysis, and management will continue according to Forest Service policy (see FSM 2670.22, 2672.1) so long as those policies remain in effect." However, without MIS designation there is no legal requirement or guarantee that fisher monitoring programs will continue in the future on national forests. Forest Service policy as outlined in the Forest Service Manual does not supplant the definitive requirements to monitor MIS because the manual's policy is broad and undefined. The Forest Service Manual at 2672.1 simply states "[s]ensitive species of native plant and animal species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing," and "there must be no impacts to sensitive species without an analysis of the significance of adverse effects on the populations, its habitat, and on the viability of the species as a whole. It is essential to establish population viability objectives when making decisions that would significantly reduce sensitive species numbers." The Forest Service Manual does not require a specific monitoring program for species other than MIS. Thus, the continuation of existing monitoring programs is by no means assured in the future, whereas retaining the fisher as a MIS would legally require the Forest Service to continue monitoring population status and habitat conditions. In other words, the MIS is an important means whereby a specific program of habitat maintenance and population monitoring and regular reporting to the public occurs as part of forest plan implementation.

The importance of existing MIS has been established by recent court decisions.[2] The Chief of the Forest Service also emphasized the importance of MIS, stating in the 2004 appeal decision for the Framework that "managing habitat to maintain viable populations of the California spotted owl, the Pacific fisher, and American marten can only be assured by using subsequent site-specific evaluations and the adaptive management and monitoring strategy." The Forest Service's proposal to eliminate the fisher as a MIS removes an additional layer of protection for the species that, combined with the weakening of the 2001 SNFPA, the inadequate management plan for the Giant Sequoia National Monument, the lack of protective measures for habitat management areas, and the weakening of the Northwest Forest Plan, leads the Pacific fisher further down the road to extinction in California.

b. Sierra Nevada

Because of isolation, small population size, and continued habitat loss due to both anthropogenic and stochastic factors, the fisher population in the southern Sierra is at risk of extinction (Lamberson et al. 2000, Truex et al. 1998). Lamberson et al. (2000), for example, concluded:

> "Theoretical implications of the effects of stochastic phenomenon on small populations suggest that unless fishers in the southern Sierra can maintain high vital rates (reproduction and survival), the population may face imminent extinction… Furthermore, the southern Sierra population has very low genetic diversity and this impoverishment may put it at additional risk. Without a source of immigrants from the north, the population in the southern Sierra cannot be 'rescued' or genetically enriched by new animals from other populations."

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[2] *Earth Island Institute v. U.S. Forest Service*, 442 F.3d 1147 (9th Cir. 2006); *Sierra Nevada Forest Protection Campaign v. Tippen*, 2006 WL 2583036 (E.D. Cal. 2006); *Sierra Club v. Eubanks*, 335 F. Supp. 2d 1070 (E.D. Cal. 2004).

In light of this information, it is clear that any management plan for the Sierra Nevada must do two things to ensure the long-term survival of the fisher in the Sierra Nevada—maintain and enhance existing fisher habitat and facilitate the recolonization of fishers into the central and northern Sierra, ultimately re-connecting the two remnant California populations. Indeed, Truex et al. (1998) concluded:

> "Long-term management of fisher habitat in California should aim to restore and recruit large structural elements necessary for resting and denning while maintaining stands with high canopy closure… Recolonization of the central and northern Sierra Nevada may be the only way to prevent fisher extinction in the isolated southern Sierra Nevada population."

A substantial obstacle that must be addressed before fishers in the southern Sierra can be reconnected with fishers in northern California is the existence of habitat bottlenecks in portions of the northern and central Sierra Nevada. In particular, portions of the Eldorado, Tahoe, and Plumas National Forests are characterized by checkerboard ownership, which has led to habitat fragmentation, and areas west of Yosemite National Park in the Stanislaus and Sierra National Forests have been negatively impacted by the combined effects of large fires and logging. For example, the Forest Service concluded that "the central Sierra Nevada is the most fragmented [region in the Sierra] with a high number of highway crossings and several areas burned by large, severe wildfires, sometimes occurring across multiple ownerships," adding that "in the central and northern Sierra Nevada, patterns of fragmentation and connectivity depend on management of private lands," (USDA 2000). Addressing these bottlenecks should be a priority in any management plan for the Sierra Nevada.

To date, the Forest Service has failed to enact comprehensive and effective measures to protect the fisher and its habitat in the Sierra Nevada. Instead, current regulations consist of inadequate standards in the revised Sierra Nevada Forest Plan Amendment, vague direction to provide consideration for fishers at the project level in individual forest plans, and a network of "habitat management areas" that lack effective guidelines to provide real protection for the fisher and its habitat.

Habitat Management Areas

Based on an extensive review of the literature and communications with furbearer biologists and at the request of the Regional Forester for California's national forests, Freel (1991) recommended establishment of fisher habitat management areas (HMAs). HMAs were to be large enough to support a fisher reproductive unit with one male home range and two adjacent female ones and to be connected to other HMAs via corridors of suitable habitat. In response to this report and concern over the status of the fisher and other furbearers, several Sierra Nevada national forests designed and established HMAs (Questionnaire from Lynn Sprague, Regional Forester, Pacific Southwest Regional Office USDA Forest Service to National Forests of the Sierra Nevada 1998). The Sierra Nevada Forest Plan Amendment Final Supplemental EIS (Section 3.2.2.1) stated that "many forests have identified and manage for a habitat network and linking corridors for forest carnivores. These areas and their management vary by forest depending on habitat availability, detections, and other factors. Some of these networks have been established by forest plan amendment." However, the HMA strategy is similar to the SOHA strategy developed for the spotted owl and thus has many of the same problems (see Thomas et al. 1990). Namely, isolated "pairs" of fishers surrounded by unsuitable habitat are unlikely to persist because as individual pairs are lost due to deterministic factors or demographic or environmental stochasticity, there is little chance that habitat will be recolonized, eventually leading to collapse of the entire population. Indeed, Bombay and Lipton (1994) in a review of the effectiveness of the Eldorado National Forest's fisher HMA network conclude:

> "Despite this analysis, it is not at all clear that a network of single-pair habitat areas, connected by riparian corridors, is a desirable way to manage habitat for fisher populations. Literature on minimum viable populations would seem to indicate otherwise."

Even if the HMA strategy were effective, however, the Forest Service has not consistently implemented it and has failed to enact effective measures to protect habitat within the HMAs. Only five of the Sierra Nevada national forests developed a network and only three of these have incorporated standards and guidelines for their HMAs into their forest plans. In general, these guidelines provide little direction for management of the HMAs and allow continued logging. Only the Lassen's plan restricts existing uses by only allowing salvage logging, which still can potentially degrade fisher habitat (USDA Lassen National

Forest 1993). However, the majority of the Lassen's HMAs were placed in existing wilderness, meaning this guideline only applies to a small portion of the Lassen's timber base. Both the Sierra and Stanislaus allow continued logging in the HMAs with few specific restrictions to protect fisher habitat beyond vague statements like "maintain sufficient habitat" and some minimal requirements to retain some snags and logs. For example, management plans for two of the seven HMAs on the Sierra National Forest fail to contain guidelines strictly prohibiting logging that reduces canopy closure, stand size, or other stand attributes below levels required by the fisher (Styger 1995, Sorini-Wilson 1997).

Considering that most forests acknowledged that they had difficulty finding sufficient high-quality habitat to create the HMAs and had to include poor quality habitat, this lack of regulation ensuring adequate protection in HMAs is particularly egregious. For example, the Lassen acknowledges that 33 percent of their HMAs consists of unsuitable habitat. Similarly, the Sierra National Forest management plan for the Browns Meadow HMA acknowledges that half of this HMA has road densities of 6 miles/mile^2, and half has road densities of 3 miles/mile^2, but fails to recommend that any roads be obliterated (Styger 1995) despite the fact that low-capability fisher habitat should have road densities no more than 3 miles/mile^2 and that high capability habitat should have road densities no more than ½ miles/mile^2 (Freel 1991).

Table 18. Status of fisher habitat management areas in Sierra Nevada National Forests.

National forest	Developed fisher HMA network	Incorporated into Forest Plan	HMA management guidelines from the Forest Plan
Sequoia	No	N/A	N/A
Sierra	Yes	Yes	Continue existing uses when they do not preclude usage by the species. Permit limited yield logging utilizing salvage, sanitation and individual and group selection methods with some retention of snags and logs. Management plans developed for two of seven HMAs.
Stanislaus	Yes	Yes	Develop management plans. Permit low yield, uneven age logging with guidelines to retain some snags and logs.
Eldorado	Yes	No	Suggested guidelines never adopted.
Tahoe	Yes	No	N/A
Plumas	No	N/A	N/A
Lassen	Yes (HMAs tentatively identified)	Yes	Only allow salvage logging.

Beyond the HMAs, a few of the Sierra Nevada national forests have guidelines pertaining to the fisher in their Land and Resources Management Plans, including the Sierra, Inyo, and Tahoe National Forests. These guidelines are for the most part vague and ineffectual. For example, the Tahoe National Forest Land and Resource Management Plan (USDA Tahoe National Forest 1990) states "develop and implement silvicultural practices to maintain or improve furbearer habitats." To date, there have been no amendments to the Tahoe plan incorporating any such practices, thus the Tahoe's plan contains no specific guidelines to protect fisher habitat. The Sierra National Forest's Land and Resource Management Plan is the only forest with a firm guideline to protect the fisher, requiring protection of a 120-acre area around denning sites if in closed forest and a 500-acre area if in open forest. However, this requirement falls far short of protecting enough suitable habitat to support a viable, reproducing fisher population. Many of the national forests in the Sierra Nevada are now revising their forest management plans, and whether protective measures for fisher under these plans will be adequate remains to be seen. However, if recent trends towards weakening standards and guidelines for fisher conservation by the Forest Service are any

indication, it is likely that these revised forest plans will continue to allow loss and fragmentation of habitat. Perhaps the most egregious example of the Forest Service's efforts to weaken protections for the fisher and its habitat is the 2004 overhaul of the 2001 Sierra Nevada Forest Plan Amendment.

Sierra Nevada Forest Plan Amendment

In the early 1990s, concerns about the conservation status of the California spotted owl – a species that shares many habitat associations with the Pacific fisher – and the inadequacy of existing regulatory mechanisms to protect the owl instigated a technical review of the owl's status and recommendations for management (Verner et al. 1992). This report suggested interim guidelines for conservation of spotted owls in the Sierra Nevada, conditioned upon additional research to refine and improve protective measures. In 1993, the Forest Service issued a decision which amended the forest plans in the Sierra Nevada to incorporate the interim guidelines, and circulated a draft EIS for an updated California spotted owl management plan. Soon after, the Sierra Nevada Ecosystem Project ("SNEP Report:" Centers for Water and Wildland Resources 1996) was submitted to Congress in 1996. This report contained a wealth of information about historical and current forest conditions and threats to the natural resources of the Sierra Nevada ecosystem. A federal advisory committee was convened to review the draft EIS for spotted owl management that took into account the SNEP report. This advisory committee determined that the draft EIS was inadequate, and recommended that the scope of the EIS be expanded to include management guidelines for a host of other issues beyond the spotted owl, including riparian ecosystems, old-growth forests, and other species such as the Pacific fisher. In 1998, the Forest Service initiated a process that culminated in the 2001 Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision and FEIS, also known as the "Framework."

The Framework was designed to "significantly improve the conservation strategy for California spotted owls and all forest resources." The multi-year process included dozens of public meetings and involved many scientists both inside and outside the Forest Service. Some of the provisions of the Framework designed to protect and manage old forests and associated wildlife species such as fishers included:

(1) the protection of a 'Southern Sierra Fisher Conservation Area' within which 60 percent of each watershed was to have dense (>60 percent) canopy cover;

(2) the designation of 4.25 million acres of Old Forest Emphasis Areas (OFEAs) and the promotion of old-growth conditions in OFEAs by restricting harvest of trees above 12 inches DBH and not reducing forest canopy by more than 10 percent;

(3) the protection of all old growth stands 1 acre or larger by managing them as OFEAs; and

(4) the implementation of standards and guidelines limiting removal of medium and large trees (>20 inches DBH), canopy cover (>50 percent), large snags, and down logs throughout general forest areas.

In sum, the original Framework provided some minimum protection for fishers by retaining medium and large diameter trees in OFEAs and smaller old growth stands, by maintaining canopy cover at a minimum of 50 percent and limiting reductions in canopy cover to 10-20 percent in general forests, and by establishing a Southern Sierra Fisher Conservation Area to protect currently occupied habitat, within which the majority of each watershed would be managed for dense canopy cover.

Almost immediately following the adoption of the 2001 SNFPA Record of Decision, the newly installed Bush Administration pushed to weaken its conservation measures to allow more logging, under the guise of "increasing flexibility and efficiency in fuels management as well as providing more economically feasible approaches of implementing the fuels reduction provisions of the decision," (Sierra Nevada Plan Amendment Review Team Meeting with Owl Scientists, June 27-28, 2002). At the direction of the Chief of the Forest Service, the Regional Forester and the Sierra Nevada Forest Plan Amendment Review Team circulated a revised Supplemental EIS (SEIS) that significantly increased logging throughout the Sierra Nevada. The revised SNFPA Record of Decision was signed on January, 2004. The SEIS significantly weakened regulations protecting fishers in the Sierra Nevada in the following ways:

Limited Operating Period – The original Framework had required a limited operating period for all projects in a 700-acre buffer around fisher den sites during the breeding period. The 2004 SEIS eliminated this limited operating period for projects other than vegetation treatments, even though road-

building, recreation, and other human activities can adversely impact fishers. No information was provided in the SEIS or Biological Assessment justifying this change in limited operating period.

Southern Sierra Fisher Conservation Area – The Southern Sierra Fisher Conservation Area was established to protect the remaining occupied fisher habitat in the mountain range. The 2001 FEIS (ROD at p. 8) described the desired future condition for the Southern Sierra Fisher Conservation Area as within each watershed, a minimum of 50 percent of the mature forested area is habitat of at least travel or foraging quality (presumed to have at least 40 percent canopy closure) and at least an additional 20 percent of the mature forested area is habitat of resting or denning quality (presumed to have at least 60 percent canopy closure). In addition, the desired future condition for forest carnivore den sites (ROD at p. 10) should include at least two large conifers (>40 inches DBH) per acre and one or more large oaks (>20 inch DBH) per acre with suitable denning cavities and >80 percent canopy closure. The 2001 Framework guideline for the Southern Sierra Fisher Conservation Area directed that more than 60 percent of each watershed in the area (outside the WUI zone) be dominated by trees >24 inches DBH and >60 percent canopy cover. Together, the desired condition and guidelines would have conserved and restored a majority of dense habitat required by the fisher within each watershed in the Conservation Area. However, the guideline was eliminated in the 2004 SEIS, because, according to an "informal analysis" conducted internally by the Forest Service, "the average value for the forested proportion of a sub watershed within the SSFCA with dense habitat is 37%," and therefore it was "difficult to determine a single threshold to guide landscape level management across the diverse habitats that comprise the species [*sic*] range." SEIS at section 3.2.2.1. In other words, because most of the watersheds failed to support enough suitable habitat, and because an informal, non-published, internal Forest Service analysis found that some watersheds occupied by fishers had less than 60 percent of the watershed with suitable dense habitat, the Forest Service eliminated the guideline for watersheds to support at least 60 percent suitable habitat – one of the only guidelines in the original Framework to offer relatively strong protection for currently occupied landscapes. Contrary to published scientific studies (e.g., Zielinski et al. 2004a), the SEIS provided no detailed, useful information about the subwatersheds, such as whether subwatersheds with lower amounts of suitable habitat were occupied by a male or a female fisher and what age class, whether females were breeding in these subwatersheds, whether animals in lower-quality subwatersheds were forced to have larger home ranges to encompass more suitable habitat, whether reproductive success was lower in subwatersheds with less suitable habitat compared to those with higher amounts of suitable habitat, and other information necessary to justify deviating from recommendations established using available scientific data painstakingly gathered over many years by qualified fisher scientists. In fact, data from the Sequoia National Forest indicate that in watersheds containing fisher den sites, 83 percent of the 700-acre buffers around fisher dens and 61 percent of the sub watersheds containing these dens have >60 percent canopy cover. In his expert declaration for an appeal of the SEIS, fisher scientist Dr. Reginald Barrett stated:

> "The FSEIS justifies the weakening of the SSFCA standard by referring to unpublished data and analysis that allegedly indicate 'that the majority of sub watersheds … do not have 50% of the forested area of the watershed in 60% canopy closure.' (FSEIS, p. 139). However, this explanation is not persuasive. The SSFCA was explicitly based on published research of fisher home ranges in the southern Sierra Nevada. Even assuming that many watersheds in the southern Sierra do not currently meet the standard does not justify the Forest Service's failure to manage for complying with the standard. Given that the fisher's status is indisputably imperiled, weakening an existing standard and aiming for a 'desired condition' that falls short of the guidelines suggested by the best available research is unjustified."

The SEIS (pp.247-248) predicts approximately 145,000 acres, or 31 percent of the Southern Sierra Fisher Conservation Area containing >50 percent canopy cover would be logged. The 2004 SEIS's elimination of the requirement to retain high-quality fisher habitat within the majority of each watershed throughout the one remaining region of the Sierra Nevada that is still occupied by fishers is entirely unjustified and clearly puts the species at additional risk of extinction.

OFEAs, Small Old-growth Stands, and Medium and Large Trees – In addition to weakening protection for fisher habitat at the watershed scale within the southern Sierra fisher conservation area, the 2004 SEIS eliminated retention standards for structural elements such as large trees and snags and downed wood in all land allocations throughout the Sierra Nevada, allowing significant degradation of fisher denning, resting, and foraging habitat (as well as degradation of habitat for spotted owls, American

martens, northern goshawks, and other old-forest dependent species). The OFEAs were designed in part to provide habitat for fishers and other old-forest dependent species and to promote habitat connectivity and dispersal. The size of the OFEAs was based on the capability to support 14 female and 7 male fishers, and the spacing between them was designed to be within the fisher's dispersal distance. With respect to large trees, the original Framework included a harvest diameter limit of 12 inches within OFEAs and 20 inches in general forest and threat zones, which cover the vast majority of the fisher's currently occupied habitat in the southern Sierra Nevada and potential habitat for recolonization in the northern and central Sierra Nevada. The 2004 SEIS replaced these standards with a harvest diameter limit of 30 inches applicable in all land allocations. In effect, the plan would allow removal of many if not all medium-large (12 to 30 inch) trees in logged areas in currently occupied and future fisher habitat. The 2004 SEIS also allows canopy cover to be reduced by as much as 30 percent, to a minimum of 40 percent and even lower in some instances. These changes are not in accord with all the research documenting Pacific fisher habitat requirements. According to Dr. Barrett, "these medium and large trees, in combination with larger trees and snags and dense canopy closure, comprise an important element of high quality fisher habitat, and their removal could significantly degrade existing and potential fisher habitat." Dr. Barrett further noted:

> "Not only are large trees important, but new research demonstrates that medium-large trees (12-24" dbh) are also an important element of fisher habitat, particularly in the southern Sierra. At the home range scale, forests dominated by medium-large trees (12-24" dbh) "composed the greatest proportion of home ranges" in the Sierra study area. (Zielinski et al. [2004b], p. 23). At the rest site scale, the same authors found that 12-24" dbh trees constitute the most frequent size classes surrounding fisher rest sites. (Zielinski et al. [2004a])."

The 2004 SEIS eliminated meaningful protection of OFEAs and smaller old-growth stands by allowing harvest of large trees up to 30 inches DBH and managing them similar to general forest. In the southern Sierra, these old-forest areas provide crucial habitat for fisher denning, resting, and foraging, and in the central and northern Sierra, protection of fisher habitat attributes in OFEAs and smaller old-growth stands would allow for future recolonization and recovery of the species to a larger portion of its former range. The weakening of habitat protections under the SEIS significantly reduces the likelihood of fisher survival and recovery in the Sierra Nevada.

The revisions to the original Framework were ostensibly implemented to increase flexibility in fuels management – and indeed, the SEIS claims (at p. 250) that "the largest events affecting viability of fisher populations in the southern Sierra appear to be large stand replacing wildfires." However, as noted by Dr. Barrett in his appeal declaration, "whereas the future risk of wildfire is conjectural, the likelihood that proposed logging will degrade fisher habitat in the short term is far greater." Moreover, Dr. Barrett stated, "the Forest Service has failed adequately to explain why removing medium-large trees and significantly reducing canopy cover is necessary to reduce the risk of stand replacing wildfire or to acknowledge the extent to which such logging is likely to degrade fisher habitat." In other words, not only is the threat to fishers from fire unknown, but the SEIS' solution to the unknown threat unnecessarily degrades currently suitable habitat because harvesting medium and large trees is ineffective anyway in reducing severe fire. In essence, the SEIS proposes to destroy fisher habitat in order to save it. Section 3.2.2.1. of the SEIS asserts that although two studies (Zielinski et al. 2004a and Self and Kerns 2001) found that stands in the intermediate size class of trees were selected by fishers, "the trees actually used were among the largest available." This research was cited as a justification for logging the medium and larger-sized trees up to 30 inches DBH, with the Forest Service implying that trees less than 30 inches DBH are not important elements of fisher habitat because they are not selected for actual denning and resting sites. In fact, Zielinski et al. (2004a at p. 488) specifically stated that "resting fishers place a premium on continuous overhead cover…but prefer resting locations that also have a diversity of sizes and types of structural elements." The habitat surrounding denning and resting sites is also an important component of resource selection by fishers. In general, the results of numerous research studies documented that fishers require many large trees, snags, and logs of both conifers and hardwoods distributed within their home ranges, continuous high canopy cover, and structural diversity (i.e. variation in tree size). These habitat elements would be eliminated under modified prescriptions in the SEIS, and there is simply no scientific justification to support the SEIS' modified prescriptions either from a fisher habitat or fire-risk reduction perspective. Zielinski et al. (2004a) stated (at p. 489) "if the response [by management to the threat of

severe fire] includes significant reduction in canopy or density of vegetation, it could affect the habitat value for fishers." This is exactly the response in the 2004 SEIS.

In an effort to understand the potential impacts to fishers of logging prescriptions allowed under current regulations, Truex and Zielinski (2005) modeled fisher habitat before and after fuel treatments within the ongoing Fire and Fire Surrogate study being conducted at Blodgett Forest Research Station and Sequoia-Kings Canyon National Park. Blodgett Forest Research Station is located in the Eldorado National Forest in the central Sierra Nevada, where the fisher has been extirpated, while Sequoia-Kings Canyon National Park in the southern Sierra Nevada is currently occupied by the species. At Blodgett, treatments included mechanical logging, mechanical and prescribed fire, prescribed fire alone, and no treatment, whereas at Sequoia-Kings Canyon treatments included only spring burn, fall burn, and no burn. The authors assessed change in predicted probability of use (as an index of habitat quality) for fishers using resource selection functions reported in Zielinski et al. (2004a). At Blodgett, any treatment involving logging significantly reduced suitability of fisher resting habitat and canopy closure, while the fire-alone treatment was similar to no treatment. At Sequoia-Kings Canyon, the late-season burn treatment had significant impacts on fisher habitat suitability as well as canopy closure. The study areas used in their research already had relatively low predicted habitat value for fishers prior to treatment, thus the authors noted (at p. 15) "although the decrease in predicted resting and foraging habitat value attributed to the treatments was small, relatively modest reductions in habitat value at sites that are already of relatively low predicted value may have disproportionately greater impact on habitat recovery." Moreover, the fire-only treatment had essentially no negative impacts on fisher habitat conditions at Blodgett, although late-season burns did reduce probability of use at Sequoia-Kings Canyon. The conclusion was that habitat manipulations such as those allowed in the revised SNFPA would "result in short-term reductions in habitat quality," although the authors also assumed that the relative impacts of vegetation management projects are "considerably less than large-scale catastrophic fires." Again, however, impacts from catastrophic fires are speculative while impacts from logging are known.

Recolonization of fishers into portions of their range from which they have been extirpated is critical to the long-term viability of the species (Truex et al. 1998). The 2004 SEIS would allow substantial additional degradation of fisher habitat in the northern and central Sierra Nevada. In particular, the SEIS allows full implementation of the Quincy Library Group pilot project, which significantly increases logging in the northern Sierra Nevada above and beyond that allowed even under the SEIS' revised standards and guidelines. Impacts include not only logging but significant road building, further fragmenting the landscape. The U.S. Fish and Wildlife Service has stated that the QLG pilot project "will disproportionately affect suitable habitat for [the fisher]" and "the Service is concerned that the proposed project will preclude recovery of this species within the project area and throughout the Sierra Nevada."[3] The U.S. Fish and Wildlife Service also has stated that "retaining suitable habitat within and outside of the Southern Sierra Fisher Conservation Area is necessary to maintain linkage between the southern Sierra Nevada population and the population in northwest California."[4] The impact of the 2004 SEIS will be to reduce the likelihood of the fisher's recolonization of the central and northern Sierra Nevada, thus precluding any hope for the fisher's recovery in California.

Finally, the 2004 SEIS significantly weakened protection for eastside forests in the Sierra Nevada. The fisher inhabits eastside pine habitat within the southern Sierra fisher conservation area, and historically inhabited eastside forest types in the central and northern Sierra Nevada as well (Grinnell et al. 1937). The SEIS eliminated any retention standards for canopy cover in eastside forests and raising the maximum diameter limit of trees to be harvested from 24 inches to 30 inches. The U.S. Fish and Wildlife Service recognized that maps of fisher observations from 1961 to 1982 and from 1983 to 1993 showed fisher locations in eastside forests.[1] The SEIS itself admitted that there are no guidelines to protect fisher habitat in eastside forests. This egregious omission of any protection whatsoever in eastside forests is yet another failure of existing regulatory mechanisms to ensure the conservation of the fisher.

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[3] USDI Fish and Wildlife Service. 1999. Comments, review and informal consultation on the draft environmental impact statement for the Herger-Feinstein Quincy Library Group Forest Recovery Act Pilot Project. August 17, 1999. Pages 11 and 12.

[4] USDI Fish and Wildlife Service. 2001. Formal endangered species consultation and conference on the biological assessment for the Sierra Nevada Forest Plan Amendment final environmental impact statement. January 11, 2001. Page 134.

In sum, leading fisher scientists and available scientific data indicate that the revised 2004 Sierra Nevada Forest Plan Amendment is grossly inadequate to protect occupied and potential fisher habitat from additional degradation from logging, and thus fails to prevent further population declines – potentially leading to the extinction of the species in the Sierra Nevada. Yet even the inadequate provisions for fisher in the SNFPA are not immune to further weakening by the Forest Service. One example is the Kings River Project, an administrative study, described above, which is exempted from the SNFPA standards. Another example of the Forest Service's pattern of weakening protections for fisher on public lands is a recent management plan for the Giant Sequoia National Monument.

Giant Sequoia National Monument Management Plan

By executive proclamation 7295 on April 15, 2000, President Clinton established the Giant Sequoia National Monument, encompassing 327,769 acres. The Monument restricted construction of new roads and timber production, allowing removal of trees for personal use only and in cases where it is clearly needed for ecological restoration and maintenance or public safety. Timber sales already under contract or with Decision Notices signed in 1999 were able to go forward. The restriction on logging as intended under the proclamation would have provided protection for the fisher within its boundaries, and for many individuals in the region, as 24 percent of detections from track plate surveys conducted from 1989-1994 (Zielinski et al. 1997a) occurred within the Monument boundary. The proclamation directed the Forest Service to prepare a management plan for the Monument. Unfortunately, the management plan adopted in January 2004, which amended the 1988 Sequoia National Forest Land and Resource Management Plan as amended by the 2001 Framework, allowed significant logging of fisher habitat under the guise of 'fire protection' and 'ecological restoration.' Moreover, the four timber sales already under contract would have impacted habitat for 23 of approximately 70-150 female fishers remaining in the southern Sierra Nevada. Together, the management plan and existing timber sales would have resulted in serious adverse impacts to this small, isolated, highly imperiled fisher population. Based largely on impacts to the fisher, and the fact that its conservation status was finally becoming widely recognized as extremely dire, two federal court decisions in the northern district of California prohibited logging to proceed in the four existing timber sales and under the 2004 Monument management plan.

The Forest Service's Record of Decision and Final Environmental Impact Statement for the Giant Sequoia National Monument were adopted in January, 2004. All administrative appeals of the plan were denied in January, 2005. The Final EIS predicted that approximately 63,840 acres would be treated in the Monument in the first decade of implementation of Modified Alternative 6. In all land allocations – including the newly created Fisher/Old Forest allocation which replaced the OFEA, General Forest, and Southern Sierra Fisher Conservation Area allocations, treatments could involve logging trees up to and including 30 inches DBH, under the guise of fire-risk reduction and reestablishing 'more natural' structural conditions. The standards and guidelines include maintaining 60 percent canopy closure over 50 percent of the watershed "based on local information regarding fisher habitat and the need to protect habitat, communities, and other valuable resources from the effects of severe wildfire." This standard was lower than the 2001 Framework standard to maintain 60 percent canopy closure over 60 percent of each watershed. The Monument plan's standards and guidelines also allow canopy cover in mature forest habitat to be reduced up to 30 percent within a treatment unit, and overall canopy can be reduced to as low as 40 percent. Furthermore, the Monument Plan "would emphasize retaining road access for public use and for management activities similar to current access levels, approximately 900 miles of roads." ROD at p. 10. Given the known negative impacts of roads on fishers, and the fact that vehicle collisions with fishers were described by one Forest Service biologist as relatively common in the region, this emphasis further threatened the viability of the fisher in the southern Sierra. Finally, the Monument plan's standards and guidelines allowed vegetation treatments even within the 700-acre buffer around known fisher den sites. The Monument was originally designated to protect the largest groves of redwoods outside Sequoia National Park from additional degradation, yet the management plan actually reduced protection for large trees and snags and canopy cover below that offered by the 2001 Framework which it amended.

Two recent federal court decisions regarding the Giant Sequoia Monument declared both the 2004 management plan and the existing timber sales illegal. In August 2006, the northern district declared the Monument plan was illegal for several reasons. The court determined that the Monument plan did not conform to the 2001 Framework and, in particular, the standards and guidelines that applied to the Fisher/Old Forest allocation in the Monument directly conflicted with those governing land allocations in

the 2001 Framework by allowing logging of trees up to 30 inches DBH. A second court decision ruled that the Forest Service failed to properly consider significant new information on the extremely endangered status of the Pacific fisher when it approved operating plans for the four timber sales within the Monument that would have severely degraded fisher habitat. The court decision cited the Ninth Circuit Court of Appeals, in that "the Forest Service appears to have been more interested in harvesting timber than in complying with our environmental laws."

These instances confirm the lack of adequate protection for fishers on national forest system lands under existing regulatory mechanisms in the Sierra Nevada.

c. Northern California

Populations of the Pacific fisher in its California-southern Oregon range are isolated from the larger continental population and from each other. Recent genetic analysis indicates that gene flow historically occurred from British Columbia to the southern Sierra (Drew et al. 2003, Wisely et al. 2003) Such gene flow may be important to the long-term survival of the Pacific fisher in California and the west coast. Thus, protection measures for the fisher must be considered within the context of their ability to facilitate recolonization of fishers into enough of their historic range in Washington and Oregon to enable gene flow to occur across populations.

The Northwest Forest Plan

Protections for late-successional forests and associated species on both public and private lands in the Northwest Forest Plan were designed largely for the northern spotted owl, marbled murrelet (*Brachyramphus marmoratus*), and salmonids. Despite the fact that spotted owls, murrelets, salmonids, and fishers are all associated with late-successional forests and that the loss of such forests has been used as a proxy for loss of habitat, as was done with the owl (USDI 1990), the degree to which the habitat needs of the owl, marbled murrelet, and anadromous fish overlap with the habitat needs of the fisher is undetermined and there is likely some divergence. For example, because both the marbled murrelet and the spotted owl have the ability to fly over areas of unsuitable habitat, they may be less sensitive than the fisher to habitat fragmentation or dispersal barriers, such as major roads. As a result, reserve designs or protection measures designed around habitat needs for these avian species are unlikely to facilitate recovery of the fisher to a larger and more stable portion of their range. Indeed, Lewis and Stinson (1998) concluded:

> "the preservation and management of older stands for northern spotted owls, marbled murrelets and protection of structure in riparian areas for salmonids in Washington may provide areas of suitable habitat for fishers in the future. However, fishers require larger areas than spotted owls, and may require more extensive habitat connectivity of closed-canopy stands."

Where fishers have been considered in management plans on private and public lands, it has generally been as an afterthought and specific measures to protect the fisher have generally not been enacted. The Northwest Forest Plan is no exception to this pattern.

On April 13, 1994, the Forest Service and Bureau of Land Management adopted the Northwest Forest Plan, which amended all planning documents to provide "management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl," including the fisher (USDA and USDI 1994). Unfortunately, the Plan failed to enact specific protections for the fisher, allowed continued habitat degradation, and does little to facilitate recovery of the fisher to a larger and more viable portion of its range. Furthermore, the Forest Service recently eliminated one of the few measures in the Plan that may indirectly benefit fisher – the 'Survey and Manage' provision. Also, the Bureau of Land Management is proposing to amend the Plan to eliminate late-successional reserves on 2.6 million acres in Oregon unless the reserves are needed to avoid jeopardy to threatened and endangered species (the fisher is only a candidate and thus does not receive this protection) and to declare timber production as the dominant use of those lands. This effort will further isolate the fisher and preclude recovery of the species into its historic range.

The Northwest Forest Plan had two primary objectives—to protect late-successional forests and associated species on Forest Service and Bureau of Land Management lands and to restart the federal timber program, which had been brought virtually to a halt by court orders (FEMAT 1993). To accomplish

these goals, the plan created a system of land designations, including late-successional and riparian reserves, where logging is mostly prohibited, and matrix lands and adaptive management areas, where logging is allowed with some restrictions (USDA and USDI 1994).

In the late-successional and riparian reserves, logging is restricted to thinning in stands younger than 80 years old and salvage in any stand larger than 10 acres, where there has been a stand-destroying disturbance, such as a blowdown, fire, or an insect outbreak. Approximately 30 percent of federal lands in the range of the northern spotted owl were placed in late-successional reserves and another 11 percent in riparian reserves. Riparian reserves are roughly 300 feet on both sides of fish bearing streams, 150 feet on both sides of perennial, non-fish bearing streams, and 100 feet on both sides of intermittent streams.

In matrix lands between reserves, logging is allowed in stands of all ages, including late-successional forests, but treatments must retain 15 percent of the green-tree volume, 240 linear feet of logs per acre greater than 20 inches diameter west of the Cascades, 120 linear feet of logs greater than 16 inches diameter east of the Cascades, and sufficient snags per acre to support cavity nesting birds at 40 percent of potential population levels (number per acre depends on forest type). The restriction to retain 15 percent of the green-tree volume, however, does not apply in the Mt. Baker-Snoqualmie National Forest, where site-specific restrictions were to be developed, or the Oregon Coast Range and Olympic Peninsula, where protections for the marbled murrelet were believed adequate. Logging of mature or late-successional forests is prohibited in 100 acre areas around known spotted owl activity centers (drawn to include the best available habitat) and within 0.5 miles of any site occupied by marbled murrelets. In addition, logging of late-successional forests is prohibited where they occupy less than 15 percent of a watershed. Matrix lands were designated on 16 percent of federal lands in the range of the northern spotted owl and include 17 percent of remaining late-successional forests (USDA and USDI 1994).

Adaptive management areas, which comprise 6 percent of lands covered by the Plan, are open to logging, but only as part of experiments to "develop and test new management approaches" (USDA and USDI 1994 ROD). Another 36 percent of federal acres in the range of the northern spotted owl are in congressionally withdrawn areas (30 percent), such as wilderness and national parks, and administratively withdrawn areas (6 percent), such as research natural areas. A majority of these areas, however, occur in high elevation forest types not utilized by the fisher.

The Northwest Forest Plan did not classify the Pacific fisher as a 'Survey and Manage' species (USDA and USDI 1994), meaning that the Forest Service is not required to survey for fisher before logging or conducting other activities. Furthermore, no protection is provided for fisher denning or resting sites, allowing the Forest Service to remove stands fisher may be using to raise young. Similarly, there are no requirements to protect habitat within fisher home ranges or to provide connecting habitat between fisher home ranges. Thus, if habitat utilized by individual fishers is protected it will only occur by accident through protection provided to the northern spotted owl or other 'Survey and Manage' species.

As noted above, one of the primary goals of the Northwest Forest Plan was to restart the federal timber program. Approximately 17 percent of remaining late-successional forests were placed in matrix lands and logging under the Plan is targeted towards these lands (USDA and USDI 1994 and 1999). USDA and USDI (1999) concluded:

> "The PSQ [probable sale quantity] is heavily dependent on harvesting late-successional forests for 3 to 5 more decades until early-successional stands begin to mature and become available for harvest. Although only one-third of the 3.4 million acres suitable for harvest are late-successional forest, about 90% of PSQ over the next decade will be derived from harvest of late-successional forest."

Thus, the Northwest Forest Plan is dependent on liquidating remaining late-successional forests on matrix lands to meet sale volumes promised under the Plan. Indeed, a biological assessment to determine effects on listed species of logging in the Willamette Province, including the Mt. Hood and Willamette National Forests and the Eugene District of the Bureau of Land Management, determined that remaining habitat for the northern spotted owl on matrix lands would be entirely eliminated in 28 years (Byford et al. 1998). Considering that late-successional forests have declined by as much as 80 percent (USDI 1990) and that habitat is likely a limiting factor for the fisher in the Northwest (FEMAT 1993, Lewis and Stinson 1998), allowing loss of 17 percent of remaining late-successional forests is counter to the survival and recovery of the Pacific fisher. Powell and Zielinski (1994) concluded:

"Further reduction of late-successional forests, especially fragmentation of contiguous areas through clearcutting, could be detrimental to fisher conservation."

In addition, retention standards for logging are unlikely to benefit the fisher. Retained logs, snags and dispersed live trees are not sufficient to retain the properties of fisher habitat within cutting units because such units will not have high canopy closure or multiple canopy layers, which are key components of fisher habitat (e.g., Seglund 1995, Dark 1997, Truex et al. 1998, Carroll et al. 1999, Zielinski et al. 2004a). Similarly, requirements to protect 100 acres of habitat around spotted owl activity centers and to retain 15 percent of green tree volume, 70 percent of which is required to be in aggregates greater than 0.2 hectares, are unlikely to provide any suitable habitat for the fisher in the short-term because fishers avoid crossing harvested areas with low overhead cover to reach forest aggregates or spotted owl activity centers (Rosenberg and Raphael 1986, Seglund 1995, Dark 1997). Although retaining logs, snags, and green trees will confer some of the characteristics of late-successional forest to developing stands following cutting, which was the basic intent, the Plan provides no guarantee that rotation lengths will be sufficient to allow development of suitable fisher habitat, including these structures. In addition, a substantial portion of the snags, logs, and green trees may not persist to the age when suitable cover for foraging, resting, and denning habitat has developed before being logged, making such structures nominal at best. The Plan also fails to provide assurances that once habitat has developed following cutting, the spatial pattern of the habitat will be able to support resident fishers or allow dispersal of fishers to higher-quality core habitat areas.

The late-successional reserves designated under the Northwest Forest Plan fail to provide substantial protection for the existing fisher population in northern California and are unlikely to facilitate recovery of the fisher to a larger portion of Oregon and Washington, which is necessary to alleviate the current isolation of the northern California population from the larger continental population.

Much of the highest-quality fisher habitat is outside of the reserves either because these reserves are too high in elevation or because they contain logged forests. For example, Carroll et al. (1999) used a multivariate analysis of the habitat characteristics surrounding known fisher locations to develop a habitat model for northwestern California and southwestern Oregon that would predict the probability of fisher detection. According to this analysis, late-successional reserves only harbor 7.7 percent of the area with a high probability of fisher detection (>0.67). Furthermore, wilderness areas only contain 2.8 percent and national and state parks only contain 12.2 percent of the area. Thus, only 23.7 percent of those areas most predicted to harbor fishers in northwest California and southwest Oregon are currently protected (Carroll et al. 1999). Of the remaining area, 65.9 percent is either tribal or privately owned and 11.4 percent is national forest matrix lands. Similarly in Oregon and Washington, protected federal lands, including late-successional reserves, occupy a fairly small proportion of the landscape within the primary elevational range utilized by the fisher (Aubry and Houston 1992). Aubry and Houston (1992) documented that 87 percent of all reliable fisher records were from below 1,000 m west of the Cascades in Washington. Federal lands, however, only occupy 20 percent of the landscape below 1,000 m, and although 75 percent of these lands are protected, this amounts to only roughly 15 percent of the landscape below 1,000 m in Washington (Pacific Biodiversity Institute unpublished data). Similarly, in Oregon only 32 percent of the landscape below 1,000 m is in federal ownership and only about 21 percent is protected. Thus, fishers in northern California are far less likely to occur in areas where they will receive protection from logging, such as a late-successional reserve, and in Oregon and Washington most of the historic range of the fisher is outside federally protected lands.

Late-successional reserves also consist of large amounts of habitat that is probably unsuitable for the fisher because of logging. Only 42 percent of late-successional reserves and 29 percent of riparian reserves are currently dominated by medium to large conifers (>21 inches DBH)(USDA and USDI 1994), meaning that 60-70 percent of the reserves are dominated by young second growth or plantations and thus are likely not suitable habitat for the fisher. In addition, salvage logging, as allowed in the late-successional reserves, will result in further degradation of existing late-successional forest and the loss of large trees with suitable cavities for denning and resting sites. Snags formed by insect outbreaks, wind, fire, or other disturbances form an integral part of late-successional forests and high-quality habitat for the fisher, which uses snags for resting and denning (Aubry et al. 1996, Truex et al. 1998). Thus, allowing their removal is counter to the maintenance of high-quality fisher habitat and late-successional forests.

Finally, the late-successional reserves were not designed to ensure the survival and recovery of the fisher, nor were they analyzed to determine if they would serve this function. Thus, it is unknown whether or not the reserves will facilitate recovery of the fisher to a large enough portion of Oregon and Washington to reconnect populations in northern California with those in British Columbia or if the reserves will support a stable, well-distributed population of fisher. To the contrary, given that late-successional reserves harbor a small portion of the current and potential fisher habitat in the Pacific Northwest, it is unlikely that they are sufficient to accomplish these goals and ensure the survival and recovery of the fisher in California and throughout its West Coast range. Indeed, a panel of leading scientists determined that the fisher has a relatively low probability (63 percent) of having a stable, well-distributed population in Washington, Oregon and northern California (FEMAT 1993).

Despite these deficiencies, the Northwest Forest Plan had offered at least some minimal protection for some old-growth forests critical to fisher conservation by protecting some late-successional reserves, northern spotted owl sites, and occupied habitat for rare 'Survey and Manage' species. However, despite more than a century of intensive logging in the Pacific Northwest that has resulted in the endangerment of many old-forest dependent species, the timber industry strongly opposed even those minimal protections for remaining old-growth habitat and imperiled species since the enactment of the Northwest Forest Plan. Industry lobby groups persuaded the Bush Administration to initiate a multi-stage process to dismantle certain provisions of the plan. For example, the 'Survey and Manage' program was recently removed as a standard and guideline from forest management plans within the range of the northern spotted owl.

In March 2002, the Bush Administration settled an industry lawsuit involving the Survey and Manage program by proposing to eliminate the program altogether. The program required that the Forest Service and Bureau of Land Management survey for rare species and to refrain from logging where necessary to ensure their survival. While the fisher was not designated as a survey and manage species, the additional protection from logging in late-successional reserves provided some indirect benefits to fishers. The final Record of Decision to amend the Land and Resource Management Plans to remove the Survey and Manage mitigation measure standards and guidelines in national forests under the jurisdiction of the Northwest Forest Plan – including the Shasta-Trinity, Klamath, Lassen, Mendocino, and Six Rivers national forests in California –was signed in July 2007.

Moreover, the U.S. Fish and Wildlife Service issued a proposal to revise the existing designation of critical habitat for the northern spotted owl, based on a flawed draft recovery plan that was criticized by leading spotted owl biologists (see e.g., Wildlife Society comments on the Draft Recovery Plan for the Northern Spotted Owl, 9 August 2007). The critical habitat proposal included 1.8 million acres in Washington, 2.2 million acres in Oregon, and 1.3 million acres in California, totaling 5.3 million acres. The original critical habitat designation totaled nearly 6.9 million acres. Fed. Reg. 50 CFR Part 17. Vol. 72 No 112, Tuesday, June 12, 2007. While not a substitute for ESA listing for the fisher, protection of critical habitat for the spotted owl provides some protection for fisher habitat as well.

In sum, the Northwest Forest Plan allows the continued degradation of a substantial portion of remaining late-successional forests and fails to protect sufficient habitat to ensure the recovery and survival of the fisher in a stable and well-distributed portion of its historic range. Recent efforts by the timber industry and the Bush Administration to weaken the Northwest Forest Plan and slash protections for spotted owl habitat will further degrade old-growth and mature forests and push the fisher towards extinction in northern California.

Overall, the existing Forest Service regulations governing management of national forests in California do not provide sufficient standards and guidelines to protect the fisher from extinction. The 2004 changes to the 2001 Sierra Nevada Framework; the current effort to eliminate the fisher as a management indicator species on five national forests in the Sierra Nevada and one national forest in northern California; the lack of adequate protection for fisher in the 2004 Giant Sequoia Monument management plan and the Kings River Administrative Study; and the weakening of already insufficient provisions protecting fisher habitat in the Northwest Forest Plan confirm the Forest Service's disregard for the preponderance of scientific data about fisher habitat needs that were painstakingly gathered over the course of nearly two decades, and the failure of the Forest Service to follow recommendations provided by the agency's own scientists and other leading fisher experts. Given the highly imperiled and isolated status of the remaining Pacific fisher populations in California, current Forest Service regulations fail to

adequately protect the fisher, allow significant additional degradation of habitat, and contribute to the present trend towards the fisher's extinction.

II. Other Public Lands Regulations

Bureau of Land Management

Bureau of Land Management (BLM) lands are scattered throughout the foothills of the Sierra Nevada. Beck and Gould (1992) estimated that in the Sierra Nevada there are approximately 68,500 acres of potentially suitable habitat for the California spotted owl on BLM lands (Beck and Gould 1992). Many of these acres are likely not fisher habitat, however, because the owl uses habitats not utilized by the fisher, such as low elevation riparian woodlands. Forested BLM lands within the Sierra Nevada are managed partially for timber production, where uneven aged harvest is emphasized. Other BLM lands are managed primarily for livestock grazing and recreation. The fisher has not been given any special management status on BLM lands in the Sierra Nevada, nor does the BLM routinely consider or mitigate the effects of its actions on the owl.

BLM lands occupy approximately 344,200 acres in northwest California. Like national forests in the range of the northern spotted owl, BLM lands are managed under the Northwest Forest Plan. In addition to the protections provided by this Plan, 640-acre diversity/connectivity blocks were established on BLM lands, where 25-30 percent of the area should be maintained as late-successional forest, rotations should exceed 150 years, and 12-18 green trees per acre should be retained when cutting. On BLM lands outside of reserves, 15 percent retention is not required as on national forest lands. Instead, they only have to retain 6-8 green trees per acre. The same concerns regarding the Northwest Forest Plan on national forests apply to BLM lands. Lack of regulation on private lands has resulted in liquidation of most fisher habitat in squares adjacent to BLM land. As a result, any habitat provided by the Northwest Forest Plan may be unavailable to the fisher because of the fragmented distribution in which the species it is likely to occur.

Two recent developments are indicative of the BLM prioritizing timber harvest over protection for endangered, threatened, and sensitive species. First, similar to the Forest Service, the BLM signed a Record of Decision in July 2007 to amend the Resource Management Plans for districts within the range of the northern spotted owl to remove the 'Survey and Manage' mitigation measure standards and guidelines. Second, the BLM is currently proposing to eliminate the designation of late-successional reserves on 2.6 million acres of Oregon and California Railroad ("O&C") lands in Oregon. This proposal would place the O&C Act's timber provisions above other uses as defined in the Federal Land Policy and Management Act. Nauman and DellaSala (2007) note that the BLM O&C lands support approximately 900,000 acres of mature and old-growth forests, including some of the last remaining tracts of low-elevation, contiguous forests in southwest Oregon. The authors report that:

> "the BLM's proposed alternative would nearly triple logging…including a doubling of the area of old growth forests logged…In the first decade, BLM proposes to clearcut 143,400 acres or 12% of the harvest land base…In addition, the agency's preferred alternative would reduce late-sucessional reserves (LSRs) established under the [Northwest Forest Plan] by 47% from approximately 936,000 acres to 494,000 acres…"

While the BLM's O&C lands are in southwest Oregon, the population of Pacific fishers affected by the proposal is part of the same population of fishers in northwestern California. Thus, the reduction of fisher habitat proposed by the BLM in Oregon is likely to negatively impact fishers in northern California as well, by further diminishing an already small, isolated, imperiled population. Scientists have recognized that expansion of the fisher back into its historic range is critical for the recovery of the species. The BLM's proposal significantly reduces the capability of the species to re-colonize northwards through Oregon and Washington and to re-connect with the extant Pacific fisher population in British Columbia.

National Park Service

National parks in the California range of the fisher include Kings Canyon/Sequoia, Yosemite, Lassen Volcanic, and Redwood. In general, management of these Parks is consistent with the maintenance of fisher habitat. However, significant portions of most of these Parks are above the elevational range utilized by the fisher. The primary threats to fishers within National Parks are roads and recreation. For

example, four fishers were killed by vehicles from 1992-1998 in Yosemite National Park (Chow, personal communication). Heavily used trails have the potential to fragment fisher habitat and disturb fishers.

State Lands

In the Sierra Nevada, there are 16,580 acres in state parks, 13,840 acres in two state forests, and 3,320 acres held by the University of California (Beck and Gould 1992). Recreation is the main threat to fishers occurring in the state parks, but the severity of impacts probably varies between the individual parks based on use and management objectives. Logging occurs in the state forests and has substantially reduced suitable fisher habitat. For example, only 960 acres of the 4,807-acre Mountain Home State Forest in Tulare County remain in an old-growth condition and only 2,000 acres of the 9,033-acre Latour State Forest have a significant large tree component (Beck and Gould 1992). Logging is continuing on both of these state forests. Protection afforded to the Pacific fisher on state lands by existing regulations is essentially the same as on private lands, meaning there is little to no specific regulations to protect the fisher. Similarly, state forests in northwestern California comprise a small overall area in widely spaced parcels that are not managed to maintain late-successional characteristics.

III. Private and Tribal Lands Regulations

a. Private Lands

Because private lands comprise a significant portion of the Pacific fisher's range in the Sierra Nevada and northern California (Verner et al. 1992, Carroll et al. 1999), their management is critical to ensuring the presence of habitat that can support successful denning, resting, foraging, and dispersal of individuals. This is particularly true both of private lands on which fishers are currently found in the southern Sierra Nevada and northern California, as well as of private lands in the central and northern Sierra Nevada that are important to facilitating fisher dispersal between the two populations.

California Forest Practices Rules

The primary body of regulation affecting management of the fisher on private lands is the California Forest Practices Rules (hereinafter cited as "the Rules"). The Rules are administered by the California Department of Forestry and Fire Protection (CDFFP), and are the regulations implementing the Z'berg Nejedley Forest Practices Act of 1973 (4 Pub. Res. Code Ch. 8). The Rules provide for timber harvest practices and site preparation practices to be utilized. The Rules require timber operators to produce a Timber Harvest Plan (THP) that is intended to serve as a substitute for the planning and environmental protection requirements of the California Environmental Quality Act of 1970 (Pub. Res. Code sections 21000-21177). THPs are comprised of a lengthy checklist and supporting documentation, or in the case of the majority of the plans exempted from the THP process, by 1-2 page applications. The Rules allow significant alteration of fisher habitat and do not provide protection of elements essential to fisher habitat, such as large trees, snags and downed wood, and high canopy closure. The lack of direction to protect these habitat elements has resulted and continues to result in degradation and destruction of late-successional habitat utilized by the fisher. Beardsley et al. (1999), for example, conclude:

> "Any increase in old-growth area in the Sierra Nevada ecosystem, would have to come mostly from the unreserved areas of the national forests, because these forests contain most of the forests having a mean diameter greater than 21 inches (59,000 acres of that was already old-growth). Most of the area in private ownership is expected to be managed for non-old-growth values."

Lack of forests with late-successional characteristics on private lands is not surprising given that the applicable rules require maximizing timber production utilizing intensive logging methods, and fail to provide any effective protection for fishers.

In the following sections we discuss numerous ways in which the Rules are inadequate to provide for the fisher and its habitat. In support of this discussion, we reference a review of 416 timber planning documents that were submitted to the California Department of Forestry between 1990 and 1998, from an analysis conducted for the federal ESA petition to list the Pacific fisher (Greenwald et al. 2000). Timber planning documents were selected from 18 locations within the range of the fisher. Each location was described by an 8,000 acre circle. Any timber planning document that occurred partially or wholly within the 8,000 acre area was included in the analysis.

First, the Rules fail to recognize the fisher as a "Sensitive Species." The Rules contain no explicit protection for the fisher, in part because it is not a designated sensitive species under the Rules. If this classification were given, the Board of Forestry would be required to "consider, and when possible adopt...feasible mitigation [measures] for protection of the species" that are based on the best available science (Forest Practice Rules § 919.12 (d)). Even if the fisher was designated as a sensitive species, however, protection of the species is not assured since the only real requirement is that the Board "consider" feasible mitigation measures, and there is no requirement that mitigation measures actually be implemented. While designation as a sensitive species provides almost no real protection, lack of such designation means the fisher has no explicit protection whatsoever under state regulation.

The Rules offer no protection for fisher denning sites on private lands. Protecting the den trees themselves as well as sufficient habitat to buffer the effects of disturbance is important to ensuring reproductive success (Campbell et al. 2000). Lamberson et al. (2000) demonstrate in a simple population growth model that both female survival and fecundity must be high for the fisher population to be stable in the southern Sierra Nevada, where the documented numbers of fishers are extremely low (Campbell et al. 2000). Because there are so few fishers in the southern Sierra, the disruption of den sites and associated habitat would likely result in the extirpation of the species from the Sierra Nevada. Similarly, on the north coast, where low female survival is a cause for concern (Truex et al. 1998), failure to protect den sites is counter to maintaining a stable population.

Logging as allowed under the Rules results in degradation and destruction of critical features of habitat for the fisher. Because the logging practices named in the Rules are focused on the use of methods to achieve maximum timber production, extensive depletion of fisher habitat has occurred and will continue to occur.

For all logging prescriptions under the rules that apply to the THP process, silvicultural objectives are defined as follows: "[t]he RPF [registered professional forester] shall select systems and alternatives which achieve *maximum sustained production* of high quality timber products." (F.P.R. 14 CCR Ch. 4 § 913) (emphasis added). The Rules favor regeneration methods for achieving this objective (F.P.R. 14 CCR Ch. 4 § 913 (a)). Regeneration methods "are designed to replace a harvestable stand with well spaced growing trees of commercial species. Even age management systems shall be applied…" (F.P.R. 14 CCR Ch. 4 § 913.1).

This objective of "maximum sustained production" of timber is in direct conflict with the retention of the characteristics that comprise high-quality fisher habitat. For example, this objective and the regeneration methods described depend on the removal of large trees to provide high-quality timber, which in turn leads to the removal of den, rest, and forage sites of the fisher. Regeneration methods have resulted in the removal of key components of fisher habitat, such as large, old trees, multi-layered canopies, snags, and downed logs (Powell and Zielinski 1994) over a substantial portion of the private lands in the Sierra Nevada and north coast. Indeed, this is the clear intent of the Rules by stating that harvest should be designed to create "a harvestable stand with well spaced growing trees of commercial species." Specific regeneration methods recommended in the Rules include clearcutting, used in 51 of the 416 cases reviewed by Greenwald et al. (2000), in which all of the stand is removed at once; seed tree regeneration, in which most of the stand is removed, and then the few remaining seed trees are removed in a second step (20 cases); shelterwood regeneration, in which a stand is removed in three steps (39 cases); transition (21 cases); and selection and group selection logging (82 cases). Many THPs proposed more than one of these harvest prescriptions. These regeneration methods entail complete removal of forest canopy and large trees, and as is clear by their definitions, would result in elimination of fisher habitat. In addition, regeneration methods result in significant reductions in canopy closure. This has the potential to severely degrade and/or destroy fisher habitat by reducing canopy closure to less than that selected by fishers, and by eliminating the multi-layered canopies that characterize the species' habitat. In addition, the goal of maximum timber production and the various harvest methods are likely to result in removal of merchantable snags and or trees appropriate for the future recruitment of large snags (Ohmann et al. 1994). As described above, Britting (2002) and Greenwald et al. (2000) found that since 1999 there has been an increase in even-aged management and the use of clearcutting on private lands in the Sierra Nevada, and this management class now generally exceeds all other types.

The Rules also recommend some uneven-age regeneration prescriptions, including transition, selection, and group selection logging (F.P.R. 14 CCR Ch. 4 § 913.1, 913.2). The uneven age methods involve removal of individual trees or groups of trees. Though occurring over several entries, these methods on private lands also are likely to result in removal of habitat characteristics required by the fisher—large, old trees, snags, and dense, multilayered canopies. Verner et al (1992) found that traditional selection logging has resulted in depletion of large, old trees. Beardsley et al. (1999) affirm this in concluding that there are few large trees on private lands. There is no reason to assume that selection logging on private lands would be more likely to result in maintenance of fisher habitat than re-generation logging.

Lastly, the Rules define several "intermediate treatments." (F.P.R. 14 CCR Ch. 4 § 913.3) These treatments include both commercial thinning and sanitation-salvage logging. Under the Rules, commercial thinning is defined as follows:

> "Commercial thinning is the removal of trees in a young-growth stand to maintain or increase average stand diameter of the residual crop trees, promote timber growth, and improve forest health. The residual stand shall consist primarily of healthy and vigorous dominant and codominant trees from the preharvest stand (F.P.R. § 913.3)."

This treatment is designed to maintain young, evenly spaced stands of healthy, straight trees. Generally, such stands lack most or all of the stand components required by the fisher (Powell and Zielinski 1994). From the Greenwald et al. (2000) review of 416 timber planning documents, it does not appear that commercial thinning is a dominant logging prescription in the areas reviewed. Of the 416 planning documents reviewed, only 28 utilized commercial thinning methods. The sanitation/salvage method was one of the most commonly utilized prescriptions under exemptions to the timber planning process (see below) and is defined in the Rules as removal of trees that are "insect attacked or diseased trees…[or, for sanitation logging] trees…that are dead, dying, or deteriorating" because of damage from a variety of causes (F.P.R. 14 CCR Ch. 4 § 913.3 (b)). The Rules provide little criteria for defining what constitutes a "dying or diseased" tree. Further, the rules state that "the RPF shall estimate the expected level of stocking to be retained (*see* Forest Practice Rules, 14 CCR Ch. 4 § 913.3 (b))," rather than prescribing specific stocking levels. Thus, it is clear that this prescription could result in removal of numerous large trees, significant reduction in canopy closure, and removal of all merchantable snags or potential snag recruitment trees.

In addition to intermediate and regeneration methods, there is an additional but ill-defined catch-all prescription of "alternative" that was used in 32 of the 416 of cases reviewed by Greenwald et al. (2000). These prescriptions appear to allow the destruction of key habitat components, as do the regeneration prescriptions described above.

In sum, the regeneration methods and intermediate harvest methods are likely to be extremely destructive to critical characteristics of fisher habitat, including large trees and multilayered forest canopy. Without effective restrictions, logging conducted under these Rules has destroyed and will continue to destroy and degrade fisher habitat over a significant portion of its range. Logging operations exempt from stocking and analysis requirements are also likely to pose significant threats to fisher habitat. The Rules exempt a number of logging operations from the Timber Harvest Planning process. Approximately 69 percent (287 out of 416) of the timber harvest documents reviewed by Greenwald et al. (2000) were in this category. Specific exemptions from the THP process include "harvesting of dead, dying, or diseased trees of any size" (utilized in approximately 175 reviewed cases), logging of 3 or less acres (25 cases), "other" (57 cases), and a number of other lesser used exemptions (F.P.R. 14 CCR Ch. 4 § 1038).

The various exemptions from the THP process and requirements include a number of specific restrictions. The exemption for harvest of "dead, dying, or diseased trees" was utilized most often in the cases reviewed by Greenwald et al. (2000). This exemption allows logging of no more than 10 percent of the average volume on each acre. In addition, a number of specific restrictions of potential impacts are built in to the exemption. For example, new road construction is prohibited. However, there are no specific restrictions on impacts to fisher den sites or habitat. For example, there are no restrictions on the size of trees removed. In addition, the exemption guidelines do not limit the frequency in which an exemption can be used for the same area. In numerous cases, the Greenwald et al. (2000) review of timber planning documents indicated that exemptions had been submitted each year for as many as seven years on

the same area. In most cases, the areas with repeated exemptions exceeded 20,000 acres in size. Under this exemption, private landowners can enter stands as often as an exemption is filed (often yearly) and remove up to 10 percent per acre of volume, eventually removing all attributes of suitable fisher habitat.

In sum, the dead, dying and diseased exemption results in the degradation of important characteristics of fisher habitat. A CDFFP forester estimated that only about 10 percent of exempted plans are subject to any review by the CDFFP, and stated that plans filed under this exemption are considered a "non-discretionary" document, which the CDFFP is obliged to approve (pers. comm. with Dave Macnamara to N. Greenwald). Finally, "emergency management" of timber is also exempted from the requirements of the THP process. This exemption applies to stands that have been substantially damaged by fire or other natural causes. This exemption was used in 33 of the cases reviewed by Greenwald et al. (2000). Because the Rules fail to define what constitutes a "substantially damaged stand," this exemption could be used in any number of situations that hardly constitute an emergency. For example, it could be used to clearcut a stand where a fire had burned, but left most of the trees alive.

Given the large number of acres and timber harvests occurring under these exemptions within the range of the fisher, this lack of protection raises serious concerns about the effects of logging on fisher habitat. Coupled with the degradation and destruction of fisher habitat that is occurring under the THP process, current regulation of logging on private lands is clearly not adequate to protect the fisher from additional population declines.

The Rules' requirement for mitigation of significant impacts to non-sensitive species fails to provide practical protection to the fisher or its habitat. While the Forest Practices Rules provide no explicit protection of the fisher and its habitat, the Rules do require that where significant impacts to non-listed species may result, the forester "shall incorporate feasible practices to reduce impacts" (F.P.R. § 919.4, 939.4, 959.4). However, the Rules do not mandate surveys be conducted for fishers, do not require identification of fisher habitat, and provide no information concerning possible thresholds over which impacts to fisher habitat or the species might be "significant." No explicit requirements or technology for assessing cumulative impacts exist. Thus, it is very unlikely that this requirement would result in significant additional protection for fisher habitat.

The Rules' provision to "incorporate feasible practices to reduce impacts" where significant impacts to non-listed species may occur provides almost no protection for the fisher because impacts, significant or not, are not identified. Further, the Rules fail to identify what constitutes a significant impact, and reduction of impacts is optional, rather than required.

The Rules' requirements for assessment of impacts to late successional forests and for mitigation of impacts do not appear to result in any significant protection of habitat for the fisher. The Rules require very limited assessment of impacts to and almost no protection for late-successional forest stands within THP areas (F.P.R. § 919.16, 939.16, 959.16). The Rules require that "when late successional stands are proposed for harvesting and such harvest will significantly reduce the amount and distribution of late succession forest stands," then information about these stands must be included within the THP (F.P.R. § 919.16.). In practice, this provision is almost never invoked. Of the 416 timber harvest documents within the range of the fisher that were reviewed by Greenwald et al. (2000), late-successional forests were mentioned in only seven cases. Thus, out of the 2,366,753 acres of private land impacted by these timber harvests, only 728 acres of late-successional forest habitat were identified.

The failure of timber harvest documents to identify impacts to fisher habitat with late-successional forest characteristics appears to be due to several factors. First, by definition under the Forest Practices Act, late-successional forest stands less than 20 acres in size are not recognized. Conclusions from Beardsley et al. (1999) and Bolsinger and Waddell (1993) suggest that large diameter trees that would be needed to satisfy the definition of CWHR classification 5M, 5D, and 6 occur at extremely low densities on private lands. Thus, the few scattered large trees that may exist on private lands are unlikely to occur in sufficient densities within stands exceeding 20 acres to merit identification as late-successional forest. It is likely that the last remnants of late-successional forests on private lands lack protection because they cover too small an area. Large, green residual trees in stands smaller than 20 acres are often the only remaining complex structural elements in a matrix of younger forest on some intensively managed private lands, and as such they provide important habitat for wildlife species like the fisher that normally are associated with older forests (Hunter and Bond 2001). Second, no analysis of late-successional forest is required unless the

timber harvest plan itself would result in a significant reduction of habitat. However, the Rules fail to provide guidance on what might constitute a significant reduction in late-successional forest habitat or require private landowners to sum losses of late-successional forests across ownerships. Thus, it is possible for a cumulatively significant reduction of late-successional forest to occur because the THP process allows incremental steps in this loss to be ignored. Even if invoked, however, this provision requires analysis and mitigation of impacts only when feasible (F.P.R. § 919.16 (a), (b).). No actual protection of old forest characteristics or acres of habitat is required.

The late-successional forest provision provides little protection to older forests even if invoked, and is invoked in practice in so few cases that it appears unlikely that this provision is providing meaningful protection for even a small proportion of fisher habitat.

The Rules' requirement for retention of snags provides little or no protection to this feature of fisher habitat. Although snags are an important component of fisher habitat and are important den and rest sites, the Rules list numerous conditions under which snags may be removed and fail to require that a minimum number of snags be retained. Further, the Rules suggest removal of large (F.P.R. § 919.1 (d)) snags near roads and ridge tops (F.P.R. § 919.1 (a)(1), (a)(2)). Of the 416 timber harvest documents reviewed by Greenwald et al. (2000), only five discussed retaining snags. Of these, three documents indicated retaining only snags that were visibly used by wildlife, one indicated that non-merchantable snags would be retained, and one indicated that all merchantable and non-merchantable snags would be retained. Eighty-two of the 416 timber harvest documents stated that snags would be removed near roads, skid trails, and landings, or more broadly. Reasons given for removal of snags included "hazard," fire danger, and a statement that merchantable snags would be removed. It was not clear that any snags would be retained in the remaining cases.

The Rules fail to require retention of a minimum number of snags and encourage removal of snags to such a degree that it is extremely unlikely that snags would be retained at levels needed to maintain suitable habitat for the fisher. In practice, few timber harvest documents appear to require retention of snags.

Additional protections for the listed northern spotted owl and marbled murrelet in northern California fail to provide significant protection for the fisher on private lands. Under the California Forest Practice Rules, private landowners wishing to harvest timber within the range of the northern spotted owl must avoid "take" of an owl, which is defined as disruption or impairment of feeding, breeding, or sheltering. Determination of take is made by the U.S. Fish and Wildlife Service based on a review of information on suitable habitat, owl locations, owl surveys in the project area, and the planned harvest. A landowner can avoid a take determination by applying the following guidelines to any owl activity center within 1.3 miles of the project boundary: nesting habitat must be maintained within 500 feet of the activity center, sufficient roosting habitat must be maintained within 500-1,000 feet of the activity center to support roosting and provide protection from predation and storms, 500 acres of owl habitat must be provided within a 0.7 mile radius of the activity center, and 1,336 total acres must be provided within 1.3 miles of any activity center. Landowners can avoid U.S. Fish and Wildlife Service oversight of their Timber Harvest Plans if they develop a "spotted owl management plan," which requires the same retention standards outlined above except that all of the 1,336 acres of habitat within 1.3 miles must be maintained as nesting or roosting habitat rather than foraging habitat. A landowner also can avoid U.S. Fish and Wildlife Service oversight of individual timber harvest plans by creating a "habitat conservation plan" (HCP). The Rules do not specify provisions to protect the marbled murrelet, instead stating that if a project is likely to result in "take" of a murrelet, then an incidental take permit from the U.S. Fish and Wildlife Service must be obtained.

Although studies indicate that spotted owls and fishers are associated with many of the same habitat characteristics, there is no guarantee that protecting owl habitat will provide substantial protection for the fisher. Indeed, because fishers require larger areas and are more sensitive to habitat fragmentation than owls (Lewis and Stinson 1998), habitat retained around owl activity centers may be unavailable to the fisher. Even this limited amount of protection, however, is not applied on many private lands in northern California. Instead, the largest industrial owners have opted to create HCPs and receive an incidental take permit from the U.S. Fish and Wildlife Service, allowing them to destroy late-successional forests surrounding owl activity centers and occupied murrelet habitat.

HCPs by the two largest private landowners in northern California provide little protection for the fisher. Both the Simpson Timber (450,000 acres) and Pacific Lumber Companies (200,000 acres) have adopted HCPs for lands under their management (Simpson 1992, Pacific Lumber Company 1999). Neither of these plans contains specific provisions to protect the fisher. Instead, they both work under the assumption that protections for the northern spotted owl, marbled murrelet, or anadromous fish will suffice to protect the fisher, despite lack of any data or analysis to support this claim. In particular, fishers were not surveyed or studied in conjunction with either plan and thus there is no basis for claims that habitat protected by either plan provides substantial benefit to the fisher.

Adopted in 1992, the Simpson HCP sets aside 39 parcels with an equal number of owl activity centers, totaling 13,242.5 acres. The parcels range in size from 61.3 to 2002.5 acres with a majority (27) under 300 acres. Considering that this acreage is divided into 39 parcels and that the HCP fails to designate travel corridors of suitable habitat between the parcels, much of this habitat is likely unavailable to the fisher. Even if this same amount of acreage was protected in one single block, however, it would be unlikely to support a viable and well-distributed population of the fisher because the total acreage of the parcels only roughly equals the size of two male fisher home ranges (Truex et al. 1998). In exchange for protecting this limited amount of habitat, Simpson received permission to take 3-5 owl pairs per year for the next 30 years, meaning the retention standards for owl activity centers described above are waived. Based on the requirement to protect 1,336 acres within 1.3 miles of all owl activity centers under the waived retention standards, protection for 30-50 owls could have resulted in protection of roughly 40,000-67,000 acres.

The Pacific Lumber Company's HCP requires sale of 7,400 acres to the United States Government to protect old-growth redwood trees, set aside of 7,728 acres for the marbled murrelet, establishment of riparian buffers, maintenance of 108 owl activity centers, retention of some structural components post-harvest, and maintenance of 10 percent of each watershed in late-seral condition. Riparian buffers range from 30 feet on intermittent streams to 170 feet on fish bearing streams, of which 100 feet is off-limits to harvest and 70 feet is open to limited harvest. Retention standards include leaving 4.8 snags/acre >15 inches DBH, four live cull trees, all live hardwoods >30 inches DBH, and two logs/acre >15 inches diameter and over 20 feet long.

Despite these protections, the Pacific Lumber HCP is unlikely to provide significant protection for the fisher because it allows continued habitat loss and fails to enact specific protections for the fisher, besides future monitoring. The HCP allows logging of a substantial portion of remaining late-successional forest on Pacific Lumber Company lands. Of an estimated 26,147 acres of old-growth (12 percent of their total lands), 57 percent is available for harvest (USDI et al. 1999). It also allows Pacific Lumber to take 37 owl territories and provide minimal protection for 28 more, meaning the retention standards for activity centers described above are waived. Similar to the Simpson HCP, the total protected acreage (15,128 acres) is small compared to the home range requirements of the fisher, there is no guarantee the habitat is currently or will be utilized by the fisher, and travel corridors were not designated to ensure availability of habitat for the fisher. Finally, retention of snags, live trees, large hardwoods, and logs will retain some of the characteristics of quality fisher habitat. However, because the HCP lacks a provision that these stand characteristics be retained in stands with suitable canopy cover in a spatially explicit manner to facilitate their use by fishers, there is no reason to believe that the HCP will ensure the continued existence of the fisher on Pacific Lumber Company lands.

In conclusion, few or none of the logging prescriptions described in the Rules would result in retention of habitat features critical to the maintenance of fisher populations on private land. Logging practices within the range of the Pacific fisher appear to be extensive, sometimes affecting each acre an average of six times over the past eight years. Further, the Rules do not provide any measures that offer explicit protection for the fisher, provide no effective measures to protect fisher habitat in any meaningful quantity, and fail to provide a mechanism for identifying individual or cumulative impacts to the fisher or its habitat on private lands. Finally, there is no evidence to support claims that protections for the northern spotted owl, marbled murrelet, or anadromous fish are sufficient to protect the fisher. The net result is that the Rules do not regulate logging on private lands in a manner that is adequate to maintain fisher habitat or populations on private land within California.

SPI Candidate Conservation Agreement with Assurances

Fisher conservation on private lands is especially difficult given a current lack of suitable fisher habitat on private lands in California, the inadequate existing regulatory mechanisms to protect fisher habitat from logging on private timberlands, and the increasing trend towards clearcutting as a silvicultural method as documented in THPs. Thus, an agreement being developed between the U.S. Fish and Wildlife Service, California Department of Fish and Game, and Sierra Pacific Industries (SPI) to reintroduce fishers onto 160,000 acres of cutover timberlands (the Stirling Management Area) in the northern Sierra Nevada/southern Cascades presents a troubling new threat to the species. The Federal Register Notice for the Proposed Candidate Conservation Agreement with Assurances for Fisher for the Stirling Management Area, Sierra Pacific Industries, Butte, Plumas, and Tehama Counties, CA (Fed. Reg. Vol. 72, No. 195, October 10, 2007; pp. 57596-57598) explains:

> "Under a Candidate Conservation Agreement with Assurances (CCAA), participating landowners voluntarily implement conservation activities on their property to benefit proposed species, candidate species, and species likely to become candidates in the near future. Under a CCAA, non-Federal property owners commit to implement mutually agreed upon conservation measures which, when combined with benefits that would be achieved if it is assumed that those conservation measures were to be implemented on other necessary properties, would preclude the need to list the covered species. In return for the landowner's proactive management, the [U.S. Fish and Wildlife] Service provides an enhancement of survival permit under section 10(a)(1)(A) of the Act which, if the species were to become listed, would authorize the take of a specified number of individuals."

In other words, if SPI implement agreed-upon "conservation activities" on their property, they are able to proceed with logging that may harm individual fishers. In exchange for allowing fishers to be re-introduced into the Stirling Management Area, the company would receive a permit to "take" a specified number of those fishers, even if the fisher is eventually listed as endangered or threatened under the federal Endangered Species Act. On paper, the reintroduction may seem like a benefit to fishers; however, the reality is that the Stirling Management Area is poor habitat for reintroduction, and the conservation measures proposed by SPI are insufficient to maximize the success of the reintroduction. Astoundingly, under the agreement, SPI would not be required to change their current management practices on the Stirling Management Area to benefit fisher habitat.

It is well-established that optimal fisher habitat is comprised of large blocks of contiguous and interconnected late-successional forest with a high level of structural diversity, high canopy closure, large trees and snags, downed wood, and few openings (see references herein). Unfortunately, the habitat on the Stirling Management Area is far from optimal. The CCAA states "[o]ver the 20-year period of the agreement there will be a net increase in the amount of fisher denning/resting habitat on the enrolled lands from the current amount of approximately 23% to approximately 33% of the total enrolled acreage." Yet, rather than requiring that the private lands selected for fisher reintroduction consist of high-quality habitat as defined in the published literature, the CCAA allows SPI to decide the definition of suitable fisher habitat. According to the Associated Press (December 13, 2007), SPI stated that it would "clear most of the trees" from the 160,000-acre Stirling Management Area, leaving behind black oaks "for the fisher." There is no evidence that forests clear-cut of conifers and comprised mostly of regenerating black oaks provides suitable fisher habitat.

The CCAA does not oblige SPI to maintain trees of a specific size or require a minimum acreage for stands of larger trees, and provide connectivity between these stands, in order to provide suitable fisher habitat. The CCAA says only that SPI will follow their existing forest management policies, under which they define fisher habitat ("Lifeform 4") as including a minimum average of 9-20 trees per acre at least 56 cm (22 inches) diameter (CCAA at p. 13). The trees in this size class are far smaller than documented fisher denning and resting conifer trees (less than half the average size; see Tables 2 and 3), and smaller than the average size of the largest trees surrounding fisher sites in all sites except the eastern Klamath (see Table 4). Thus, the size class that SPI is willing to provide for fishers is much smaller than the size actually used by the species for resting and denning. SPI claims they are providing resting and denning structure simply by increasing the distribution of stands predominated by trees over 22 inches DBH. Given that resting and denning trees are considerably larger than 22 inches, and have deformities that take substantial time to develop, the CCAA provides little guarantee that habitat will actually be suitable. Furthermore,

although the CCAA acknowledges that the fisher is dependent on structures such as snags and downed wood, the agreement does not mandate that SPI retain snags and downed wood. SPI guidelines consider fisher habitat as >60 percent canopy cover, but the CCAA does not require that a certain proportion of a watershed contain this dense canopy cover. For example, on average more than 70 percent of female home ranges in the southern Sierra Nevada were comprised of habitat with >60 percent canopy cover (Zielinski et al. 2004b). The CCAA says only that SPI will adhere to their own guidelines, but these guidelines do not require that a certain number of snags or downed wood be retained, or that a certain proportion of area be comprised of dense canopy cover, as is important for suitable fisher habitat. Moreover, the CCAA fails to provide any measure of fisher use of or survival in the area, which would be the obvious test for the success of the CCAA.

The fisher depends on contiguous forested habitat, but the CCAA does not limit clearcutting on the enrolled lands, and does not call for large continuous areas of late-seral stage forests for fisher. The CCAA defers to SPI management practices, but SPI does not agree to provide contiguous habitat for fisher of a certain size or age class. Neither the CCAA nor SPI policies guarantee that a large area of contiguous forest will be available for fisher. Under SPI policy, regeneration units can be up to 40 acres in size and can be grouped together "to eventually provide contiguous larger habitat patches of generally the same age and structure class to benefit wildlife species," (CCAA at p. 13). Although the company claims that larger patches will eventually provide wildlife value, the reality is that larger blocks of open areas are created with their clearcutting practices and that once the trees have reached a certain size, they can be harvested. Without important habitat elements such as large trees, snags, downed wood, high canopy cover, and multi-layered canopies available in significant amounts and in large, well-connected blocks across the landscape, the Stirling Management Area remains a poor choice for a fisher re-introduction site.

Furthermore, the CCAA does not prohibit any management activities known to harm fishers. The forest management activities covered under the permit include "felling and bucking timber, yarding timber, loading and landing operations, salvage of timber, transport of timber and rock, road construction and maintenance, rock pit construction and use, site preparation, tree planting, vegetation control, pre-commercial thinning and pruning, minor forest products, grazing, and fire suppression." Fed. Reg. Vol. 72, No. 195, October 10, 2007. SPI does not agree to change their management practices to benefit fisher or to curtail timber harvest or other activities within the Stirling Management Area, other than to increase stand rotation time somewhat. The CCAA states only that a certain percentage of trees will be of a certain age class by the end of the 20 year agreement; it does not require protection for particular areas such as denning or resting sites, or for specific features such as snags and downed wood, nor does it preclude harvest as soon as the trees reach a certain age. Under the CCAA, SPI is agreeing only to continue following their existing forest management guidelines, not to alter them significantly to improve conditions for fisher in this cutover habitat. In essence, SPI is offering only to let their trees grow in accordance with current practices, which means until they reach a harvestable age, and claiming that this will provide recovery habitat for the fisher.

The 12-month finding for fisher (at p. 18789) points out that habitat on industrial timberlands under conservation strategies generally does not meet the habitat needs of fisher:

> "The HCP conservation strategies generally do not provide the large blocks of forest with late seral structure that appear to be important for sustaining resident fisher populations, particularly for providing denning and resting sites".

SPI's history of logging in the Sierra Nevada is not one of concern for fisher habitat. From the period 1999 to mid-2002, SPI submitted THPs covering a total of 68,960 acres, with 41,630 acres subjected to even-aged management (i.e., clearcutting or similar methods). Furthermore, from 1992 to 2003, SPI harvested timber on 130,365 acres in the Southern Forest District alone – more than any other private landowner, and accounting for 36 percent of the total private timberland harvested during this time period. To boot, SPI employed even-aged management as a greater proportion of acres harvested than other private landowners combined (see Table 9).

The U.S. Fish and Wildlife Service developed a policy for consideration of whether conservation efforts forestall the need for listing (Policy for Evaluating Conservation Efforts, Federal Register, Vol. 68, No. 60, March 28, 2003, p. 15100). The policy considers two primary factors: (1) "the certainty that the conservation effort will be implemented" and (2) "the certainty that the conservation effort will be

effective." Under each of these factors, the Service determines whether the agreement is sufficient based on a number of specific criteria. The CCAA does not identify a staffing level, funding level, or funding source to implement the agreement. SPI does not agree to commit funds or staff time to the preservation of fisher on their lands. Committing resources to implement the effort would include setting aside large areas of undisturbed late-successional forest on the enrolled lands for use by fisher and agreeing not to harvest these areas, but SPI does not make this commitment, nor do they agree to curtail timber harvest or other destructive activities on the enrolled lands. Moreover, no regulatory mechanisms to implement the conservation effort are in place. The CCAA does not contain any regulations requiring SPI to protect the fisher: the agreement is entirely voluntary. SPI agrees to notify FWS of activities that could lead to known take of fisher, but they do not agree to forego the activities in order to protect the fisher.

Efforts to re-introduce fishers into areas from which they have been extirpated are not only laudable but necessary to prevent extinction. However, habitat for reintroduction must be of the highest quality in order to maximize the chances that the reintroduction will succeed and to ensure that taxpayer dollars are well-spent. Aubrey and Lewis (2003) found that "although fishers have been reestablished in the southern Cascade Range in Oregon for >20 years, our results show that they have not expanded their range beyond a relatively small area, suggesting that suitable habitat in surrounding areas may be inadequate to support fishers." The authors – who are leading fisher experts employed by the Forest Service and Washington Department of Fish and Game, respectively – recommended that "comprehensive feasibility studies should be conducted prior to additional fisher reintroductions," and that "such studies include explicit considerations of objectives, habitat capabilities at multiple spatial scales, genetic suitability of potential source populations, timing of releases, possible social or economic constraints, mechanics of the reintroduction, and the optimal age, sex, and number of translocated animals, among others." None of these recommendations were discussed or considered in the agreement. Given the unsuitability of habitat on SPI land for fisher, that no activities on this land are prohibited in the CCAA, and that there is a guaranteed level of human disturbance due to timber harvest and other forest management activities, it would be irresponsible to relocate fisher onto SPI property without further study and enforceable protections for the species and its habitat.

Although we support the reintroduction of fisher into appropriate habitat in the northern Sierra Nevada, we oppose the reintroduction of fisher onto SPI land under this CCAA. Neither the CCAA nor SPI policies provide enforceable protective measures for fisher. There is no evidence that habitat on SPI properties is adequate to meet the needs of fisher or that SPI properties contain the most suitable habitat in the northern Sierra Nevada for a reintroduction. It does not promote fisher conservation to reintroduce the species into an area from which they were extirpated without addressing the causes of extirpation, namely even-aged timber harvest.

In this case, the so-called 'enhancement of survival' permit is a misnomer. Implementation of this agreement would not only fail to preclude the need to list the fisher, but actually would constitute a significant threat to the species. The U.S. Fish and Wildlife Service and California Department of Fish and Game are moving forward with fisher reintroduction into an area with a paucity of the forest structures typical of fisher habitat and under the auspices of a company for whom even-aged management is the predominant silvicultural method employed. Under the Service's own criteria for evaluating conservation efforts, the CCAA clearly does not forestall the need for listing the fisher.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires full disclosure of the potential environmental impacts of public or private projects carried out or authorized by nonfederal agencies within the state of California. Section 15065 of the CEQA Guidelines requires a finding of significance if "[t]he project has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish and wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare or threatened species." However, CEQA does not require that impacts must be mitigated. Rather it requires that if significant effects are found, mitigation must be adopted where feasible, and if determined to be infeasible, an explanation must be provided. Once significant effects are identified, the lead agency has the option of requiring mitigation for impacts through changes in the project, or to decide that overriding considerations make mitigation infeasible (Section 21002). Moreover, the bar is set

relatively high for a significance finding under CEQA; only in the rare cases that a species is on the brink of extinction and occurs in a very limited geographic area, will an individual project cause sufficient damage to meet the definition. This would be the case in areas currently occupied by fishers, and if a fisher were known to occur on a project site – which provides an important level of protection there. However, the CEQA standard would not apply in parts of the central and northern Sierra Nevada where the fisher has been extirpated.

In relation to logging projects, CEQA requirements are met through preparation of THPs. As discussed above, the California Forest Practice Rules and the timber harvest planning process are inadequate to protect fishers and their habitat.

In sum, CEQA requires analysis and mitigation where feasible for projects that are determined to have a significant effect on the environment, including wildlife populations. This has the potential to result in analysis and mitigation of effects to the fisher from timber sales and development projects in currently occupied areas, particularly if proper cumulative impacts assessments were performed. However, CEQA will not protect fisher habitat where the species has been extirpated, nor will it protect habitat on project sites within the current range but where fishers were not detected (even though it may be utilized by fishers at some point). Thus CEQA is likely unable to protect much rapidly developing fisher habitat from further degradation.

b. Tribal Lands

Information on the status and management of the fisher or its habitat on Native American lands is limited. We were only able to obtain information on the 360 km^2 Hoopa Valley Indian Reservation. Located near the center of the fisher's range in northern California, this reservation provides important habitat for the fisher (Carroll et al. 1999). In part because the fisher is of ceremonial importance to the Hupa people, the Tribe has been researching the status of the fisher on the reservation (Higley 1998). Research has included radio-collaring fishers, locating resting and denning sites, and measuring habitat. In addition, the Tribe recently enacted a forest management plan, including some protection for the fisher (Tribal Forestry 1994).

In evaluating the Hoopa Valley Indian Reservation's Plan, we recognize that the Tribe is a Sovereign Nation. We are providing the following analysis not because we think a different management regime or regulations should be imposed on the Tribe, but because management of the fisher and its habitat on the Reservation is important within the larger context of survival and recovery of the fisher on the West Coast.

Unlike any of the HCPs in the West Coast range of the fisher, the Tribe's Plan specifically prohibits forest activities from "knowingly" resulting in "take" of a Tribal species of special concern, including the fisher, without approval from the Tribal Council. However, because the Plan does not define what constitutes take or specifically prohibit activities that will result in take, it is unclear what protection this provision provides. The Plan, for example, does not specifically prohibit logging within fisher denning or resting stands, which would result in take as defined under the Endangered Species Act.

Otherwise, the Plan places 34,468 acres off-limits to logging, limits harvesting on 23,438 acres to group or single tree selection or shelterwood without overstory removal, and allows intensive timber management using a modified clearcut prescription on 36,151 acres. Under all of the above harvesting prescriptions, the goal is an 80 year rotation. Clearcuts are limited to 10 acres and must retain two-five trees and 100 cubic feet of downed wood should be left in pieces 20 cubic feet or larger. Under the shelterwood prescription, 8-14 overstory trees/acre should be retained. Retained trees, however, can be cut after 80 years. Under the group selection prescription, cutting patches are limited to two acres.

Although the Tribe's Plan sets aside a considerable portion of the Reservation, it is currently unknown whether or not this habitat is sufficient to support a viable and well distributed population of the fisher on the Reservation or in the region. All of the prescriptions will result in the continued removal of elements of late-successional forest, such as large trees, snags and logs, and high canopy closure and thus will allow for continued loss and fragmentation of fisher habitat. It is unknown to what extent 80 year old stands, which is the target rotation, provide habitat for foraging, resting or denning fishers on the Hoopa Valley Indian Reservation. In sum, although considerably more restrictive than any regulations on private lands, it is unclear to what extent the Tribe's Plan will maintain the fisher.

RECOMMENDED MANAGEMENT AND RECOVERY ACTIONS

1. Avoid logging or other activities, including salvage logging following fires, anywhere it may reduce fisher habitat value, especially in critical locations, such as the current northern portion of the occupied range near the Merced River and northwards (see Spencer et al. 2007 at p. 43).

2. If absolutely necessary, reduce risk of large areas experiencing high-severity burns within important fisher habitat by *effectively* and *strategically* treating surface and ladder fuels using the best scientific data available. Treatments should rely primarily on prescribed fire during the appropriate season rather than mechanical treatments (see Truex and Zielinski 2005). If mechanical treatments are deemed necessary, such as in areas near towns and infrastructures, protect all elements known to be important habitat features for Pacific fishers. These elements include but are not limited to medium and large conifer and hardwood trees and snags (for example, trees and snags $\geq$ 15 inches DBH), large down logs, multi-layered canopies, understory vegetation diversity and cover, and high canopy closure, especially in areas where current canopy closure from trees > 12 inches DBH is high, and in areas with high probability of use by fishers (Aubry and Houston 1992, Buck et al. 1994, Dark 1997, Jones and Garton 1994, Mazzoni 2002, Powell and Zielinski 1994, Seglund 1995, Truex et al. 1998, Carroll et al. 1999, Campbell 2004, Zielinski et al. 2004a, 2004b).

3. Modify the California Forest Practice rules to fully consider impacts to fisher from timber harvest on private lands, and to require protection of important habitat elements.

4. Support efforts to monitor the spatial and temporal abundance and distribution of important resting and denning structures throughout potentially suitable fisher habitat on both public and private lands (see Spencer et al. 2007). Monitoring should be conducted in occupied areas as well as in areas currently unoccupied but potentially important for population expansion and re-introduction efforts.

5. Using models of Pacific fisher habitat selection, identify the most suitable locations in the central and northern Sierra Nevada for potential re-introduction efforts that would also minimize impacts on the congeneric American marten (see Zielinski et al. 2005b). These locations should consist of the largest contiguous blocks of high-quality fisher habitat. Sierra Pacific Industries industrial timberlands should not be considered as a suitable location for fisher reintroduction unless a detailed, scientifically rigorous habitat assessment concludes that SPI timberlands provide the largest blocks of highest-quality habitat.

6. Modify the Kings River Administrative Project to increase habitat value for the fisher by maintaining canopy cover >70% where it exists; not reducing canopy cover to <60% over at least 70% of each watershed (or striving to create such habitat conditions over time), and retaining medium-large (e.g., $\geq$15 inches) trees and snags and large down logs (see Zielinski et al. 2004a).

7. Avoid permitting additional urban development and associated infrastructure (roads, etc.) in moderate- and high-quality fisher habitats. Projects requiring state permits within potential fisher habitat should thoroughly analyze potential impacts to Pacific fishers and eliminate any possible sources of mortality, such as open water tanks and high-speed roads without safe crossings.

8. Address the problem of free-roaming, unvaccinated dogs that can potentially transmit pathogens to Pacific fishers. Enforce leash laws, and patrol areas around urban develops in fisher habitat for free-roaming dogs.

9. Identify and resolve current barriers to Pacific fisher dispersal such as highways and urban developments. Provide a means whereby fishers can traverse barriers (i.e., bridges and vegetated overpasses over and under high-traffic roads) to connect areas of suitable fisher habitat.

CONCLUSION

A combination of historic trapping, logging, road building, urban development, and other factors has resulted in a significant diminution of the Pacific fisher's range in California and on the West Coast. Small, isolated, remnant populations in the southern Sierra Nevada and northwestern California-southwestern Oregon represent the only surviving native populations in the western United States. These populations are at serious risk of extinction because of a combination of continued habitat destruction caused by logging and development, predation, small population size, and population isolation. The entire Pacific fisher population in California may be as low as 850 individual animals. As outlined in this petition, current regulations fail to provide sufficient habitat protection or to facilitate recovery of the fisher to a larger and more stable portion of its historic range on the West Coast. All of these factors indicate the fisher merits protection under CESA.

Zielinski et al. (2004a at p. 1403) state that "the gap in the fisher historical distribution aligns well with the area of greatest increase in human influence... In these areas, homes are built in fisher habitat, roads are more common, the forests around the built environment developments are managed to reduce forest density, and there is a long history of private land management for timber (compared with public land managed for multiple uses). These factors probably conspire to render home range areas less suitable, leading to the contraction of range in this area." Threats to the fisher are significant on both public and private lands, and the State of California can offer a legal safety net for the species. The California Department of Fish and Game is currently considering approving the reintroduction of fisher onto cutover, unsuitable timberlands owned by Sierra Pacific Industries in the northern Sierra Nevada. The California Department of Forestry and Fire Protection approves timber harvest plans in fisher habitat, which have been trending towards more clearcutting as a silvicultural method. The California Department of Transportation has jurisdiction over many of the roads threatening fishers, and other state agencies are responsible for approving developments on private lands in fisher habitat. CESA § 2053 states:

> "The Legislature further finds and declares that it is the policy of the state that state agencies should not approve projects as proposed which would jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species, if there are reasonable and prudent alternatives available consistent with conserving the species or its habitat which would prevent jeopardy. Furthermore, it is the policy of this state and the intent of the Legislature that reasonable and prudent alternatives shall be developed by the department, together with the project proponent and the state lead agency, consistent with conserving the species, while at the same time maintaining the project purpose to the greatest extent possible."

All state agencies, boards, and commissions have a mandatory, affirmative duty to conserve (meaning protect and recover) state-listed species and must "utilize their authority in furtherance of the purposes" of CESA. Fish and Game Code § 2055. Thus, the State of California is in a strong position to address the greatest threats to the survival and recovery of the Pacific fisher: private lands logging, road building, and urban development. The fisher is in dire need of the protective measures provided by CESA. Therefore, we request that the California Fish and Game Commission list the Pacific fisher as an endangered or threatened species in California, so that it can be given the opportunity to recover – and so that we can offer our grandchildren the opportunity to share in the wonder of this unique, elusive, and magnificent animal.

Center for Biological Diversity
1095 Market Street, Suite 511
San Francisco, CA 94915

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State of California
Department of Fish and Wildlife

Memorandum

Date: June 10, 2015

To: Sonke Mastrup
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Status Review of Fisher**

The Department of Fish and Wildlife (Department) has prepared the attached Status Review for the Fish and Game Commission (Commission) regarding the Center for Biological Diversity's Petition to list Fisher *(Pekania pennanti,* formerly *Martes pennanti*, former common name Pacific fisher*)* as threatened or endangered pursuant to the California Endangered Species Act (CESA, specifically Fish and Game Code section 2074.6). The Commission received the petition on January 23, 2008. The attached status review represents the Department's final written review of the status of fisher and is based upon the best scientific information available to the Department.

Because fishers occur in California in two geographically separate areas with demonstrated distinct genetic differentiation, the Department treated the two geographic areas as two separate Evolutionarily Significant Units (ESUs); the Northern California ESU and the Southern Sierra Nevada ESU. The status review contains the Department's recommendation that listing of the Northern California ESU is not warranted, but to list the Southern Sierra Nevada ESU as threatened.

Regarding the scientific determinations of the threats to the fisher, the Department finds that the continued existence of fisher in the Northern California ESU is not in serious danger or threatened by the following six listing factors individually or in combination:

1. Present or threatened modification or destruction of its habitat;
2. Overexploitation;
3. Predation;
4. Competition;
5. Disease; or
6. Other natural occurrences or human-related activities.

The Department however, finds that for the fisher in the Southern Sierra Nevada ESU, the threat to its habitat from wildfire, its small population size, and the future predicted trajectory of human-related climate change do present a serious danger and threat to their continued existence. In combination, these factors indicate to the Department that listing the Southern Sierra Nevada fisher ESU as threatened is warranted.

If you have any questions or need additional information, please contact Dan Yparraguirre, Deputy Director, Wildlife and Fisheries Division at 916-653-4673 or Eric Loft, Chief, Wildlife Branch at 916-445-3555.

Attachment

STATE OF CALIFORNIA

NATURAL RESOURCES AGENCY

DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION
A STATUS REVIEW OF THE
FISHER
(*Pekania* [formerly *Martes*] *pennanti*) IN CALIFORNIA

CHARLTON H. BONHAM, DIRECTOR

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

May 12, 2015

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Acknowledgments

This report was prepared by: Richard Callas (co-lead), Dr. Deana Clifford, Pete Figura (co-lead), and Stella McMillin. Internal CDFW review was provided by Dan Applebee, Esther Burkett, Dr. Deana Clifford, Joe Croteau, and Stella McMillin. CDFW GIS analysis and mapping was provided by Kristi Cripe. Janelle L. Deshais and Linda Miller analyzed timber harvest rates within planning watersheds in northern California. Dan Applebee provided assistance with responding to comments from external peer reviewers. The Department would like to thank Dr. Lowell Diller, Dr. Mourad Gabriel, Mark Higley, Dr. Sean Matthews, Dr. Roger Powell, Dr. Wayne Spencer, Dr. Craig Thompson, Dr. Jody Tucker, and Dr. Bill Zielinski for donating their time to provide external peer review for this document.

Cover photograph © J. Mark Higley, Hoopa Tribal Forestry, used with permission.

Executive Summary

This document describes the current status of the fisher (*Pekania pennanti*) in California as informed by the scientific information available to the Department of Fish and Wildlife (Department).

On January 23, 2008, the Center for Biological Diversity petitioned the Fish and Game Commission (Commission) to list the fisher as a threatened or endangered species under the California Endangered Species Act. On March 4, 2009, after a series of meetings to consider the petition, the Commission designated the fisher as a candidate species under CESA.

Consistent with the Fish and Game Code and controlling regulation, the Department commenced a 12-month status review of Pacific fisher. At the completion of that status review, the Department recommended to the Commission that designating fisher as a threatened or endangered species under CESA was not warranted. On June 23, 2010, the Commission determined that designating Pacific fisher as an endangered or threatened species under CESA was not warranted. That determination was challenged by the Center for Biological Diversity and, in response to a court order granting the Center's petition for a writ of mandate, the Commission set aside its findings. In September 2012, the Department reinitiated its status review of fisher.

The fisher is a native carnivore in the family Mustelidae which includes wolverine, marten, weasel, mink, skunk, badger, and otter. It is associated with forested environments throughout its range in California and elsewhere in North America. Concern about the status of the fisher in California was expressed in the early 1900s in response to declines in the number of animals harvested by trappers. Predator control and other poisoning efforts, including those for porcupines, may have also impacted fisher populations. In addition to trapping and predator control, the historical decline of fisher populations has also been attributed to forest management activities which may have rendered habitats unsuitable.

Early researchers believed that in the late 1800s the range of fishers in California extended from the Oregon border south to Marin County in the Coast Ranges, through the Klamath Mountains, and through the southern Cascades and the southern Sierra

Nevada. However, recent genetic research indicates that the distribution of fishers in the Sierra Nevada was likely discontinuous, and populations in northern California were isolated from fishers in the Sierra Nevada prior to Euro-American settlement with little or no genetic exchange between them. Although the location and size of the gap (or gaps) separating these populations is unknown, it is reasonable to conclude that the gap was smaller than it is today based on records of fishers from that region during the late 1800s and early 1900s.

Currently, fishers occur in northwestern portions of the state – the Klamath Mountains, Coast Range, southern Cascades, and northern Sierra Nevada (reintroduced population) – and also in the southern Sierra Nevada, south of the Merced River. For this Status Review, the Department designated fishers inhabiting northern California and the southern Sierra Nevada as two separate Evolutionarily Significant Units (ESUs). This distinction was made based on the reproductive isolation of fishers in the southern Sierra Nevada (SSN ESU) from fishers in northern California (NC ESU) and the degree of genetic differentiation between them. No comprehensive survey to estimate the size of the fisher population in California has been conducted. Statewide, estimates of the number of fishers range from 1,000 to approximately 4,500 individuals. Evidence available to the Department indicates that fishers are widely distributed and common in northern California. Research suggests the population in the southern Sierra Nevada is comparatively small (probably less than 350 individuals), but is stable or nearly stable.

Early work on fishers appeared to indicate that fishers required particular forest types in the western US (e.g., old-growth conifers) for survival. However, studies over the past two decades have demonstrated that fishers do not depend on old-growth forests per se, nor are they associated with any particular forest type. Fishers are most typically found at low- to mid-elevations within areas characterized by a mixture of forest plant communities and seral stages, often including relatively high proportions of mid- to late-seral forests. At finer spatial scales, fishers are associated with structurally complex forests containing large trees, logs, and with moderate-to-dense canopy cover.

Fishers primarily use live trees, snags, and logs for resting. These structures are typically large and the microstructures used (e.g., cavities) can take decades to develop. Dens used by female fishers for reproduction are almost exclusively found in

live trees or snags. Both conifers and hardwood trees are used for denning; the presence of a suitable cavity appears to be more important than the species of tree. Dens are important to fishers for reproduction because they shelter fisher kits from temperature extremes and predators. Trees used as dens are typically large in diameter and are consistently among the largest available in the vicinity. Considerable time (more than 100 years) may be needed for a tree to attain sufficient size and develop a cavity large enough for a female fisher and her young. Although the number of den and rest structures needed by fishers is not well known, a substantial reduction in these important habitat elements within a given area would likely reduce the fitness of fishers inhabiting that area.

Primary threats to fishers within the both California ESUs include habitat alteration, toxicants, wildfire, and climate change. In the SSN ESU, small population size is also a threat. Most forest landscapes in California occupied by fishers have been substantially altered by human settlement and land management activities, including timber harvest and fire suppression. Generally, these activities substantially simplified the species composition and structure of forests although fishers occupy public and private lands harvested for timber. The long-term viability of fishers across their range in California will depend on the presence of den sites, rest sites, and habitats capable of supporting foraging activities. At this time, there is no substantial evidence to indicate that the availability of suitable habitats is adversely affecting fisher populations in California, although the recruitment of additional high quality habitat in the SSN Fisher ESU could increase the population size and help mitigate some of the extinction risks inherent to small populations.

Within the fisher's current range in the state, greater than 50% of the land base is administered by the US Forest Service (USFS) or the National Park Service. Private lands within the NC ESU and the SSN ESU represent about 41% and 10% of the total area, respectively. Comparing the area assumed to be occupied by fishers in the early 1900s to the distribution of contemporary detections of fishers, it appears the range of the fisher has contracted substantially. This difference is due to the apparent absence of fishers from the central Sierra Nevada, most of the northern Sierra Nevada, and portions of the north Coast Ranges. This apparent long-term contraction notwithstanding, the distribution of fishers in California has been stable and possibly increasing in recent years.

Fishers in California are frequently exposed to anticoagulant rodenticides and to other toxicants. Anticoagulant rodenticides used at marijuana cultivation sites have caused the deaths of some fishers and may affect fishers indirectly by increasing their susceptibility to other sources of mortality such as predation. Exposure to toxicants at illegal marijuana cultivation sites has been documented in both the NC and SSN ESUs. The effects of such exposure on California fisher populations remain unknown.

In recent decades the frequency, severity, and extent of wildfires has increased in California. If this trend continues, it could result in increased mortality of fishers during fire events, diminish habitat carrying capacity, inhibit dispersal, and potentially isolate local populations of fisher. The fisher population in the SSN ESU is at greater risk of being adversely affected by wildfire than fishers in northern California due to its small size and the narrow distribution of available habitat.

Climate research predicts continued climate change through 2100. The climate is projected to change at increasing rates, with an overall trend of warmer temperatures across the range of fishers in the state characterized by warmer winters, earlier warming in the spring, and warmer summers. These changes will likely not be uniform and considerable uncertainty exists regarding climate-related changes that may occur within the range of fishers in California. The SSN ESU is likely at greater risk of experiencing potentially adverse effects of a warming climate than fishers in the NC ESU due to its comparatively small population size and susceptibility to fragmentation. Nevertheless, the actual effects of future climate change on fisher populations remain very difficult to predict, and will likely vary throughout the species' range. The severity of those effects will vary depending on the extent and speed with which warming and precipitation changes occur.

The Department has provided a list of management actions to improve the likelihood of the continued existence of the fisher, including the need for: scientific studies to better understand how fishers use landscapes and to determine thresholds for important forest structural elements; implementation of large-scale, long-term monitoring of fisher populations and populations of other forest carnivores including monitoring of health and disease; and collaboration with land management agencies and researches in the southern Sierra Nevada to facilitate population expansion by increasing connectivity between core habitats and through translocation.

Executive Summary

The Department provides this status review report to the Commission based on an analysis of the scientific information available pursuant to Fish and Game Code section 2074.6. Based on this information, the Department recommends that the petitioned action to list the fisher as threatened or endangered under CESA within the Northern California ESU is not warranted and within the Southern Sierra Nevada ESU is warranted as threatened at this time.

Regulatory Framework

Petition Evaluation Process

On January 23, 2008, the Center for Biological Diversity (Center) petitioned the Commission to list the fisher as a threatened or endangered species pursuant to the California Endangered Species Act[1] (CESA) (Cal. Reg. Notice Register 2008, No. 8-Z, p. 275; see also Cal. Code Regs., tit. 14, § 670.1, subd. (a); Fish & G. Code, § 2072.3). The Commission received the petition and, pursuant to Fish & Game Code Section 2073, referred the petition to the Department for its evaluation and recommendation. On June 27, 2008, the Department submitted its initial Evaluation of Petition: Request of Center for Biological Diversity to List the Pacific fisher (*Martes pennanti*[2]) as Threatened or Endangered (June 2008) (hereafter, the 2008 Candidacy Evaluation Report) to the Commission, recommending that the petition be rejected pursuant to Fish and Game Code section 2073.5, subdivision (a)(1)[3].

On August 7, 2008, the Commission considered the Department's 2008 Candidacy Evaluation Report and related recommendation, public testimony, and other relevant information, and voted to reject the Center's petition to list the fisher as a threatened or endangered species. In so doing, the Commission determined there was not sufficient information to indicate that the petitioned action may be warranted[4].

On February 5, 2009, the Commission voted to delay the adoption of findings ratifying its August 2008 decision, indicating it would reconsider its earlier action at the next Commission meeting[5]. On March 4, 2009, the Commission set aside its August 2008 determination rejecting the Center's petition, designating the fisher as a candidate species under CESA[6, 7].

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[1] The definitions of endangered and threatened species for purposes of CESA are found in Fish & G. Code, §§ 2062 and 2067, respectively.

[2] Until recently, the fisher was known by the scientific name *Martes pennanti.*

[3] See also Cal. Code Regs., tit. 14, § 670.1, subd. (d).

[4] Cal. Code Regs., tit. 14, § 670.1, subd. (e)(1); see also Cal. Reg. Notice Register 2009, No. 8-Z, p. 285.

[5] Cal. Reg. Notice Register 2009, No. 8-Z, p. 285.

[6] The definition of a "candidate species" for purposes of CESA is found in Fish & G. Code, § 2068.

In reaching its decision, the Commission considered the petition, the Department's 2008 Candidacy Evaluation Report, public comment, and other relevant information, and determined, based on substantial evidence in the administrative record of proceedings, that the petition included sufficient information to indicate that the petitioned action may be warranted. The Commission adopted findings to the same effect at its meeting on April 8, 2009, publishing notice of its determination as required by law on April 24, 2009[8].

On April 8, 2009, the Commission also took emergency action pursuant to the Fish and Game Code (Fish & G. Code, § 240.) and the Administrative Procedure Act (Gov. Code, § 11340 et seq.), authorizing take of fisher as a candidate species under CESA, subject to various terms and conditions[9]. The Commission extended the emergency take authorization for fisher on two occasions, effective through April 26, 2010[10]. The emergency take authorization was repealed by operation of law on April 27, 2010.

Consistent with the Fish and Game Code and controlling regulation, the Department commenced a 12-month status review of fisher following published notice of its designation as a candidate species under CESA. As part of that effort, the Department solicited data, comments, and other information from interested members of the public, and the scientific and academic community. The Department submitted a preliminary draft of its status review for independent peer review by a number of individuals acknowledged to be experts on the fisher, possessing the knowledge and expertise to critique the scientific validity of the report[11]. The effort culminated with the Department's final Status Review of the Fisher (*Martes pennanti*) in California (February 2010) (2010 Status Review), which the Department submitted to the Commission at its meeting in Ontario, California, on March 3, 2010. The Department recommended to the Commission based on its 2010 Status Review and the best science available to the

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[7] Fish & G. Code, § 2074.2, subd. (a)(2), Cal. Code Regs., tit. 14, § 670.1, subd. (e)(2).

[8] Cal. Reg. Notice Register 2009, No. 17-Z, p. 609; see also Fish & G. Code, §§ 2074.2, subd. (b), 2080, 2085.

[9] See Fish & G. Code, §§ 240, 2084, adding Cal. Code Regs., tit. 14, § 749.5; Cal. Reg. Notice Register 2009, No. 19-Z, p. 724.

[10] *Id.,* 2009, No. 45-Z, p. 1942; Cal. Reg. Notice Register 2010, No. 5-Z, p. 170.

[11] Fish & G. Code, §§ 2074.4, 2074.8; Cal. Code Regs., tit. 14, § 670.1, subd. (f)(2).

Department that designating fisher as a threatened or endangered species under CESA was not warranted[12]. Following receipt, the Commission made the Department's Status Review available to the public, inviting further review and input[13].

On March 26, 2010, the Commission published notice of its intent to begin final consideration of the Center's petition to designate fisher as an endangered or threatened species at a meeting in Monterey, California, on April 7, 2010[14]. At that meeting, the Commission heard testimony regarding the Center's petition, the Department's 2010 Status Review, and an earlier draft of the Status Review that the Department released for peer review beginning on January 23, 2010 (Peer Review Draft). Based on these comments, the Commission continued final action on the petition until its May 5, 2010 meeting in Stockton, California, a meeting where no related action occurred for lack of quorum. That same day, however, the Department provided public notice soliciting additional scientific review and related public input until May 28, 2010, regarding the Department's 2010 Status Review and the related peer review effort. The Department briefed the Commission on May 20, 2010, regarding additional scientific and public review, and on May 25, 2010, the Department released the Peer Review Draft to the public, posting the document on the Department's webpage. On June 9, 2010, the Department forwarded to the Commission a memorandum and related table summarizing, evaluating, and responding to the additional scientific input regarding the Status Review and related peer review effort.

On June 23, 2010, at its meeting in Folsom, California, the Commission considered final action regarding the Center's petition to designate fisher as an endangered or threatened species under CESA[15]. In so doing, the Commission considered the petition, public comment, the Department's 2008 Candidacy Evaluation Report, the Department's 2010 Status Review, and other information included in the Commission's administrative record of proceedings. Following public comment and deliberation, the Commission determined, based on the best available science, that designating fisher as

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[12] Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f).

[13] *Id.*, § 670.1, subd. (g).

[14] Cal. Reg. Notice Register 2010, No. 13-Z, p. 454.

[15] See generally Fish & G. Code, § 2075.5; Cal. Code Regs., tit. 14, § 670.1, subd. (i).

an endangered or threatened species under CESA was not warranted[16]. The Commission adopted findings to the same effect at its meeting in Sacramento on September 15, 2010, publishing notice of its findings as required by law on October 1, 2010[17].

The Center brought a legal challenge and *Center for Biological Diversity v. California Fish & Game Commission, et al*.[18] was heard in San Francisco Superior Court on April 24, 2012. On July 20, 2012, Judge Kahn signed an order granting Petitioner Center's petition for a writ of mandate. The order specified that a writ issue requiring the Department to solicit independent peer review of the Department's Status Report and listing recommendation, and the Commission to set aside its findings and reconsider its decision. On September 5, 2012, judgment issued, and on September 12, 2012, Petitioners filed a notice of entry of judgment with the court.

Consistent with that order, at its Los Angeles meeting on November 7, 2012, the Commission set aside its September 15, 2010 finding that listing the fisher as threatened or endangered was not warranted[19]. Having provided related notice, the fisher again became a candidate species under the California Endangered Species Act[20]. In September 2012, the Department reinitiated a status review of fisher pursuant to the court's order following related action by the Commission.

Department Status Review

Following the Commission's action on November 7, 2012, designating the fisher as a candidate species and pursuant to Fish and Game Code section 2074.4, the Department solicited information from the scientific community, land managers, state, federal and local governments, forest products industry, conservation organizations, and the public to revise its 2010 Status Review of the species. This report represents

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[16] Fish & G. Code, § 2075.5(1); Cal. Code Regs., tit. 14, § 670.1, subd. (i)(2).

[17] Cal. Reg. Notice Register 2010, No. 40-Z, pp. 1601-1610; see also Fish & G. Code, §§ 2075.5, subd. (1), 2080, 2085.

[18] Super. Ct. San Francisco County, 2012, No. CGC-10-505205

[19] Cal. Reg. Notice Reg. 2013, No. 12-Z, pp. 487-488; see also Fish & G. Code, §§ 2074.2, 2080, 2085

[20] Cal. Reg. Notice Reg. 2013, No. 12-Z, pp. 487-488; see also Fish & G. Code, §§ 2074.2, 2085

the Department's revised status review, based on its consideration and analysis of scientific and other information available and including independent peer review by scientists with expertise relevant to the status of the fisher.

For the purposes of this Status Review, the Department designated fishers inhabiting portions of northern California and the southern Sierra Nevada as separate Evolutionarily Significant Units (ESUs). These units will be evaluated for listing separately where the information available warrants independent treatment and are hereafter referred to as the NC (northern California) ESU and SSN (southern Sierra Nevada) ESU (Figure 1). The use of ESUs by the Department to evaluate the status of species pursuant to CESA is supported by the determination by California's Third District Court of Appeal that the term "species or subspecies" as used in CESA (Fish & G. Code, §§ 2062 and 2067) includes Evolutionarily Significant Units[21]. To be considered an ESU, a population must meet two criteria: 1) it must be reproductively isolated from other conspecific (i.e., same species) population units, and 2) it must represent an important component of the evolutionary legacy of the species (Waples 1991).

The Department believes that separate ESUs are warranted for fishers because of the reproductive isolation of fishers in the southern Sierra Nevada from fishers in northern California and the degree of genetic differentiation between those populations. Maintenance of populations that are geographically widespread and genetically diverse is important because they may consist of individuals capable of exploiting a broader range of habitats and resources than less spatially or genetically diverse populations. Therefore, they may be more likely to adapt to long-term environmental change and also to be more resilient to detrimental stochastic events. The boundaries of each ESU represent the Department's assessment of the current range of fishers in California.

[21] *California Forestry Ass'n v. Fish and Game Commission* (2007) 156 Cal.App.4th 1535, 1547-1548.

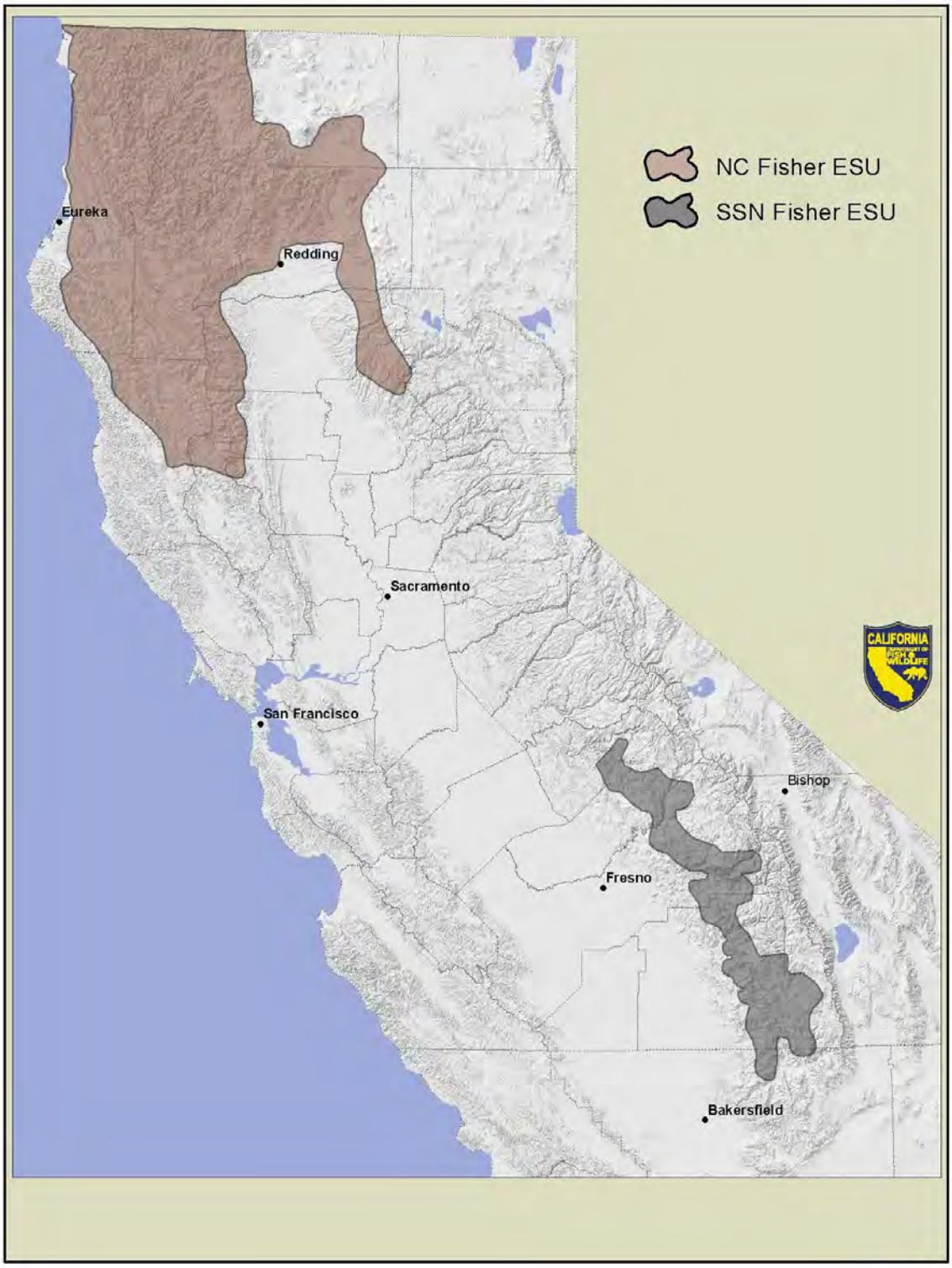

Figure 1. Fisher Evolutionarily Significant Units (ESUs) in California. California Department of Fish and Wildlife, 2014.

Biology and Ecology

Species Description

Fishers have a slender weasel-like body with relatively short legs and a long well-furred tail (Douglas and Strickland 1987:511). Though they often appear uniformly black from a distance, they are generally dark brown over most of their bodies with white or cream patches distributed on their undersurfaces (Powell 1993). The fur on the head and shoulder may be grizzled with gold or silver, especially in males (Douglas and Strickland 1999). Fishers have a single molt in late summer and early fall, and shedding starts in late spring (Powell 1993).

The fisher's face is characterized by a sharp muzzle with small rounded ears (Grinnell et al. 1937) and forward facing eyes indicating well-developed binocular vision (Powell 1993). Sexual dimorphism is pronounced in fishers, with females typically weighing slightly less than half the weight of males and being considerably shorter in overall body length. Female fishers typically weigh between 2.0 kg and 2.5 kg (4.4-5.5 lbs) and range in length from 75 cm to 95 cm (28-34 in) and males weigh between 3.5 kg and 5.5 kg (7.7-12.1 lbs) and range from 90 cm to120 cm (35-47 in) long (Powell 1993:3, 4).

Fishers are commonly confused with the smaller American marten (*M. americana*), which as adults weigh from about 0.5 kg to 1.4 kg (1-3 lbs) and range in total length from about 50 cm to 68 cm (20-27 in) (Buskirk and Ruggiero 1994). American martens are lighter in color (cinnamon to milk chocolate), have an irregular cream to bright amber throat patch, and have ears that are more pointed and a proportionately shorter tail than fishers (Lewis and Stinson 1998).

Even where they are abundant, fishers are seldom seen. Although the arboreal ability of fishers is often emphasized, most hunting takes place on the ground (Coulter 1966). Females, perhaps because of their smaller body size, are more arboreal than males (Pittaway 1978, Douglas and Strickland 1987, Powell 1993).

Systematics

Classification: The fisher is a member of the order Carnivora, family Mustelidae and, until recently, was placed in subfamily Mustelinae, and the genus *Martes*. In North America, the Mustelidae includes wolverine, marten, weasel, mink, badger, and otter. Based on morphology, three subspecies of fisher have been recognized in North America: *M. p. pennanti* (Erxleben 1777), *M. p. columbiana* (Goldman 1935), and *M. p. pacifica* (Rhoads 1898). However, the validity of these subspecies has been questioned (Grinnell et al. 1937) and (Hagmeier 1959). More recently, Sato et al. (2012:755) recommended that the subgenus Pekania be elevated to the rank of genus to accommodate the fisher, and that the genus *Martes* be used for the extant martens. In this report, we use *Pekania pennanti* as the taxonomic designation for fishers.

Common Name Origin and Synonyms: Fishers do not fish and the origin of their name is uncertain. Powell (1993) thought the most likely possibility was that the name originated with European settlers. Fitchet, fitche, and fitchew are terms used for polecats and for the European polecat's pelt, which led to the name of the domesticated polecat, "fitch ferret" and possibly to the name "fisher" (R. Powell, pers. comm.). Many other names have been used for fishers including pekan, pequam, wejack, Pennant's marten, black cat, *tha cho* (Chippewayan), *uskool* (Wabanaki), *otchoek* (Cree), and *otschilik* (Ojibwa) (Powell 1993). In the native language of the Hupa people, fishers are known as *'ista:ngq'eh-k'itiqowh*, which translates to "log-along-it scampers" (Baldy et al. 1996:36).

Genetics

Paleontological evidence indicates that fishers evolved in eastern North America and expanded westward relatively recently (less than 5,000 years ago) during the late Holocene, entering western North America as forests developed following the retreat of ice (Graham and Graham 1994:58). Wisely et al. (2004*a*) hypothesized that fishers expanded from Canada southward through mountain forests of the Pacific Coast, eventually colonizing the Sierra Nevada in a stepping-stone fashion from north to south.

Mitochondrial DNA has been used in several studies to describe genetic characteristics of fishers in California (Drew et al. 2003, Wisely et al. 2004*a*, Knaus et al. 2011). Portions of the DNA within mitochondria have been widely used in studies of ancestry

because they are rich in mutations which are inherited. Drew et al. (2003) identified three haplotypes[22] (haplotypes 1, 2, and 4) from fishers in California by sequencing portions of their mitochondrial DNA. Haplotype 1 was found in fishers from northern and southern California populations, the Rocky Mountains, and in British Columbia. Haplotype 2 was limited to fishers in northern California. Haplotype 4 was only found in museum specimens from California; however, it was present in fishers in British Columbia. Based on these findings, Drew et al. (2003) suggested that gene flow between fishers in British Columbia and California occurred historically, but that these populations were now isolated.

Subsequent investigations, using nuclear microsatellite DNA and based on sequencing the entire mitochondrial genome, reported high genetic divergence between fishers in northern California and the southern Sierra Nevada (Wisely et al. 2004*a*, Knaus et al. 2011). Wisely et al. (2004*a*:643) analyzed nuclear microsatellite DNA from fishers in northern California and the southern Sierra Nevada and reported that fishers from these areas were genetically distinct and were effectively isolated from each other. Knaus et al. (2011:11) sequenced the whole mitochondrial genome and identified three haplotypes unique to fishers in California what were not previously identified. One of these haplotypes was geographically restricted to the southern Sierra Nevada Mountains and two restricted fishers from northern California. Fisher populations in northern California and the southern Sierra Nevada as represented by haplotypes are genetically distinct and these populations likely separated before Euro-American settlement (Knaus et al. 2011:8,20).

Geographic Range and Distribution

The fisher is endemic to North America. A *Pekania* fossil from eastern Oregon provides evidence that the ancestors of contemporary fishers occurred in North America approximately 7 million years ago (Samuels and Cavin 2013:449). Modern fishers appear in the fossil record in Virginia during the late Pleistocene (126,000-11,700 years ago) (Eshelman and Grady 1984:59). During the late Holocene, fishers expanded into

[22] The term haplotype is a contraction for 'haploid genotype'. A haplotype is a group of genes that tend to be inherited together.

western North America (Graham and Graham 1994:58), presumably as glacial ice sheets retreated and were replaced by forests.

The accounts of early naturalists, assumptions about the historical extent of fisher habitat, and the fossil record suggest that prior to Euro-American settlement of North America (ca. 1600) fishers were distributed across Canada and in portions of the eastern and western United States (Figure 2). Fishers are associated with boreal forests in Canada, mixed deciduous-evergreen forests in eastern North America, and mixed coniferous forest ecosystems in western North America (Lofroth et al. 2010).

By the 1800s and early 1900s, the fisher's range was generally greatly reduced due to trapping, predator control, and large scale anthropogenic-influenced changes in forest structure associated with logging, altered fire regimes, and habitat loss (Douglas and Strickland 1987:512, 526, Powell 1993:77, Powell and Zielinski 1994, Aubry and Lewis 2003:81–82, Lofroth et al. 2010:41). Fishers have since reoccupied much of their former range, including portions of northern British Columbia to Idaho and Montana in the West, from northeastern Minnesota to Upper Michigan and northern Wisconsin in the Midwest, and in the Appalachian Mountains of New York in the East (Powell and Zielinski 1994:42).

Native populations of fishers currently occur in Canada, the western United States (southwestern Oregon, California, Idaho, and Montana) and in portions of the northeastern United States (North Dakota, Minnesota, Wisconsin, Michigan, New York, Massachusetts, New Hampshire, Vermont, and Maine). To augment or reintroduce populations, fishers have been translocated to the Olympic Peninsula in Washington State, the Cascade Range in Oregon, the northern Sierra Nevada and southern Cascades in California, and to various locations in eastern North America and Canada (Lewis et al. 2012:8).

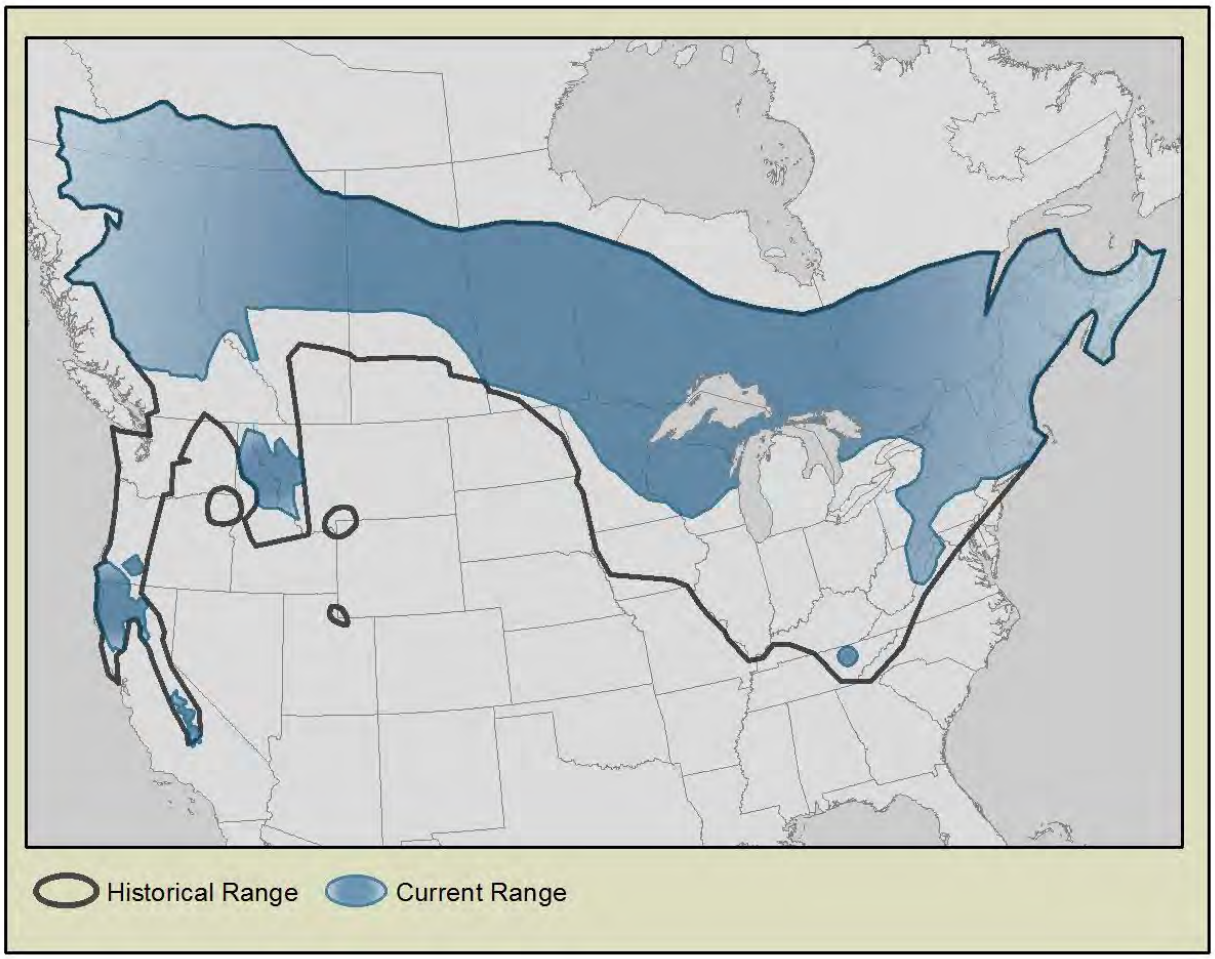

Figure 2. Presumed historical distribution (ca. 1600) and current distribution of fishers in North America. Historical distribution was derived from Gibilisco (1994:60). Refer to Tucker et al. (2012) and Knaus et al. (2011) for additional insight regarding the potential historical distribution of fishers in the southern Cascades and Sierra Nevada.

Historical Range and Distribution in California

Our knowledge of the historical distribution of fishers in California is primarily informed by Grinnell et al. (1937:214–216). They described fishers in California as inhabiting forested mountains primarily at elevations from 610 m to 1824 m (2,000 ft - 5,000 ft) in the northern portions of their range and from 1220 m to 2438 m (4,000 ft - 8,000 ft) in

the Mount Whitney region, although vagrant individuals were reported to occur beyond those elevations[23]. Information presented by Grinnell et al. (1937:219) suggested that at the time of their publication (1937), fishers were distributed throughout much of northwestern California and south along the west slope of the Sierra Nevada to near Mineral King in Tulare County. Grinnell et al. (1937:219) appear to have believed that the range of fishers in the "present time" was reduced compared to the area encompassed by their "assumed general range" from approximately 1862-1937, which included the area ranging from "the Oregon border south to Lake and Marin counties and eastward to Mount Shasta and south throughout the main Sierra Nevada mountains to Greenhorn Mountain in north central Kern County" (Grinnell et al. 1937:214–215).

Grinnell and his colleagues produced a map of fisher distribution which included locations where fishers were reported by trappers from 1919 through 1924, as well as a line demarcating what they assumed to be their general range from approximately 1862 to 1937. The authors believed that almost all the locations were accurate; however, they did note that some locations may have reflected the trapper's residence or post office. Grinnell et al. (1937) also described their examination of numerous museum specimens and detailed several anecdotal fisher sightings. Their work remains the best approximation of the distribution of fishers in California prior to the 1930s. The approximate locations of the 1919-1924 trapper reports, museum specimens, anecdotal observations, and general range boundary as mapped by Grinnell et al. (1937) are included in Figure 3.

There are no museum specimens of fishers collected in the Sierra Nevada north of the Tuolumne River. However, anecdotal evidence suggests that fishers were present in parts of the central and northern Sierra at least until the 1920s and perhaps through the 1940s. Zielinski et al. (2005:1403) suggested that the fisher population in the southern Cascades and the northern Sierra Nevada may have been substantially reduced due to trapping and habitat loss by the time Grinnell (1937) and his colleagues assessed its distribution. Price (1894) supports this assertion by providing evidence that fishers were sought after by Sierra Nevada trappers several decades prior to the assessment of Grinnell (1937).

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[23] Fisher detections are currently relatively common above 2438 m on the Sequoia National Forest (J. Tucker, unpublished data).

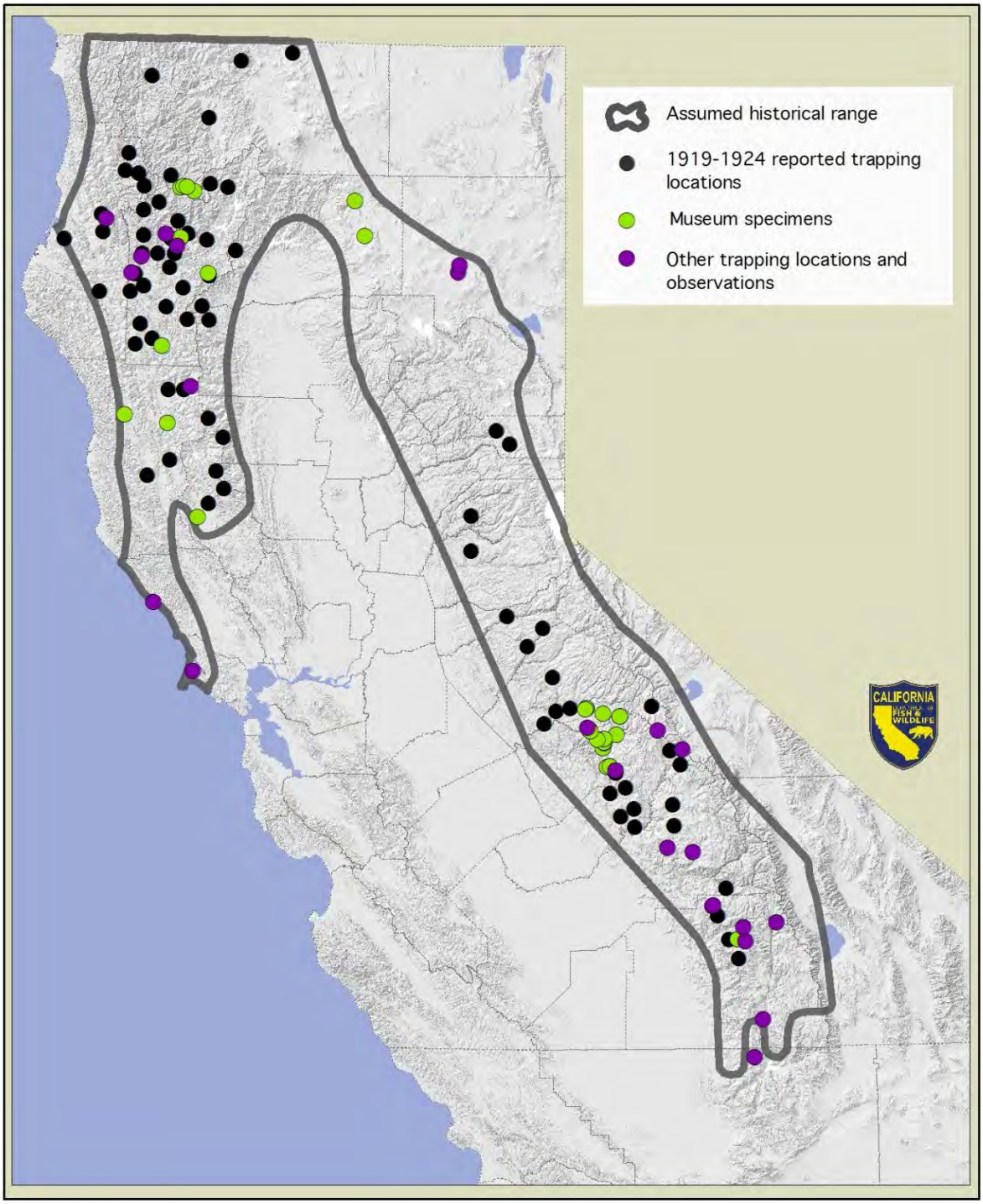

Figure 3. Historical range map of the fisher in California, based on Grinnell et al. (1937). Map includes 1) an outline of the fisher's "assumed general range within past seventy-five years" as drawn by Grinnell et al., 2) the locations of 1919-1924 fisher locations reported by trappers and mapped by Grinnell et al. (1937), 3) museum specimens examined by Grinnell et al. (1937), and 4) other trapping locations and observations mentioned in text but not mapped by the authors. Individual fisher locations were mapped by hand from descriptions of specimens or other anecdotal information.

In an 1894 publication describing his efforts to collect mammals in the Sierra Nevada (primarily in Placer and El Dorado counties) and in Carson Valley, Nevada, William Price included notes on species that he did not collect but were "commonly known to the trappers" (Price 1894). His notes for fisher were: "One individual was seen near the resort on Mt. Tallac[24] shortly before my arrival. Mr. Dent informed me they were the most valuable animals to trappers, and that he frequently secured several dozen during the winter. They prefer the high wooded ridges of the west slope of the Sierras above 4000 feet." Although Mr. Dent's specific fisher trapping locations are unclear, it seems likely the fishers were taken within the general area of the publication's focus: the Sierra Nevada between the current routes of Interstate 80 and Highway 50, as well as the adjacent Carson Valley. Mr. Dent is mentioned elsewhere in the paper as having trapped river otter in winter along the South Fork of the American River. Price also noted that martens were reported by Mr. Dent as "common in the higher forests" and "associated with the fisher". Therefore, it is unlikely that Mr. Dent was confusing fishers with martens. Price's paper indicates that trapping pressure on fishers was likely significant prior to 1900. Mr. Dent is described as having trapped for ten years. If his claim of frequently trapping "several dozen" fishers annually was accurate, it is possible that he alone may have harvested several hundred fishers.

In 1914, ten fishers were reportedly killed on the Tahoe National Forest (Our annual catch of furbearing animals. 1916) and a 1915 book on Lake Tahoe noted "the fur bearing and carnivorous animals the otter, fisher, etc., all are uncommon, though some are trapped every year by residents of the Lake" (James 1915). James distinguished fishers from martens on the basis of their relative size, and noted that both species "live in pine trees usually in the deepest forests". Five fishers were reportedly trapped in July 1916 near Placerville in El Dorado County (Winter vs. summer furs. 1917); the article described the poor price paid for the pelts, which were not in prime condition (Winter vs. summer furs. 1917). Grinnell et al. (1937) showed one trapping location in Placer County, one from El Dorado County, one from Amador County, and two from Calaveras County from 1919 to 1924. Jack Foster, a state trapper during the 1940s and 1950s who lived in or near Taylorsville (Plumas County), reported trapping a fisher in the

[24] This site is likely the historic Glen Alpine Springs resort south of Lake Tahoe and southwest of Fallen Leaf Lake. It was located near the base of Mt. Tallac.

Diamond Mountains (near the border of Plumas and Lassen counties) in 1943 (Schempf and White 1977:22)[25].

Historical evidence of fisher presence in the southern Cascades is also relatively sparse. Two fisher specimens collected in 1897 in eastern Shasta County are located in the National Museum of Natural History. One specimen was collected at Rock Creek, near the Pit River and modern Lake Britton. The second fisher was collected at Burney Mountain, south of the town of Burney. Another undated[26] specimen housed in the National Museum of Natural History was collected near Fort Crook (near modern-day Fall River Mills). Also included in the National Museum of Natural History is a fisher that was collected by C.H. Townsend somewhere in Shasta County in 1883[27]. Grinnell et al. (1937) mentioned that fishers were trapped during the winters of 1920[28] and 1930 on the ridge just west of Eagle Lake in Lassen County. In a separate publication on the natural history of the Lassen Peak region, Grinnell et al. (1930:463) reported that the pelt of the Eagle Lake fisher taken in 1920 sold for $65 and that "people who live in the section say that fishers are sometimes trapped in the 'lake country' to the west of Eagle Lake." The term "lake country" presumably refers to an area of abundant lakes in the modern-day Caribou Wilderness and the eastern portion of Lassen Volcanic National

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[25] In 1946, Mr. Foster also reportedly captured and subsequently released a fisher that had been cornered by dogs near Taylorsville in Plumas County. This record is included in the California Natural Diversity Database, but CDFW has not yet been able to locate and review the original sources of the record.

[26] This Museum of Natural History label for this specimen indicates that it was collected by "Gardener". A Captain John W.T. Gardner commanded the Army unit that built Fort Crook in 1857. Gardner went on to fight in the Civil War, and the fort was largely abandoned after 1866. Therefore, it is possible that this collection was made at some point during that period.

[27] In addition to the southern Cascades, Shasta County includes suitable fisher habitat within the Klamath Mountains and North Coast Ranges. It is thus possible that this specimen did not come from the southern Cascades. Townsend collected many mammals in Shasta, Siskiyou, Lassen and Tehama counties during 1883-1884. While most of the Shasta County specimens collected by Townsend do not have specific localities, many were made near Baird (on the Sacramento River beneath modern-day Shasta Lake.) During that period Townsend also collected numerous mammals near Mt. Lassen.

[28] This occurrence was not included on the Grinnell et al. (1937) map of 1919-1924 fisher harvest locations reported by trappers.

Park, near the junction of Lassen, Plumas, and Shasta counties. Grinnell et al. (1937:216) also showed one fisher reportedly trapped north of Mt. Shasta near the Klamath River sometime between 1919 and 1924.

Additional anecdotal evidence of fishers in the southern Cascades and/or possibly the northern Sierra is contained in annual "Fish and Game" reports produced by the Lassen National Forest in the 1920s (the Forest is comprised primarily of lands in the southern Cascades, but does include a portion of the northern Sierra). The 1920 report (Butler 1920:4) includes both fishers and martens in a list of furbearing animals found on the forest. The 1925 report (Durbin 1925:9) mentions "the trapping industry is not carried on to any great extent; however, there are a few local trappers who make a business of trapping for marten, fishers, and foxes in the high country each winter….a catch of 20 marten, one or two fox…and a couple of fisher, usually make up the catch….they usually get about $20 for marten and fisher hides…".

In northwestern California, the "assumed general range within past seventy-five years" map prepared by Grinnell et al. (1937) included portions of Lake, Mendocino, Sonoma, and Marin counties. The inclusion of Lake County and the central and northern parts of Mendocino County were seemingly based on specimens examined and trapper reports compiled by Grinnell et al. (1937). In contrast, southernmost Mendocino, Sonoma and Marin counties were seemingly included based only on two anecdotal sighting reports, one near Fort Ross (Sonoma County) and one near Inverness (Marin County) (Figure 3). To the best of our knowledge there are no other historical or verified contemporary records of fishers in Marin and Sonoma counties.

Current Range and Distribution in California

Our understanding of the contemporary distribution of fishers in California is based on observations of individual animals through opportunistic and systematic surveys, chance encounters by experienced observers, and scientific study. Fishers are secretive and elusive animals; observing one in the wild, even where they are relatively abundant, is rare. Individuals encountering fishers in the wild often see them only briefly and under conditions that are not ideal for observation. Therefore, it is likely that animals identified as fishers may be mistakenly identified. This likelihood decreases with more experienced observers.

Considerable information about the locations of fishers in the state has been collected by the Department and housed in its California Natural Diversity Database and its Biogeographic Information and Observation System. The U.S. Fish and Wildlife Service (USFWS) also compiled information about sightings of fishers for its own evaluation of the status of the species in California, Oregon, and Washington. This information includes data from published and unpublished literature, submissions from the public during the USFWS's information collection period, information from fisher researchers, private companies, and agency databases (S. Yaeger, USFWS, pers. comm.). This combined dataset represents the most complete single database documenting the contemporary distribution of fishers in California.

Aubry and Jagger (2006) noted that anecdotal occurrence records such as sightings and descriptions of tracks cannot be independently verified and thus are inherently unreliable. They and others have promoted the use of standardized techniques that produce verifiable evidence of the presence of an animal (remote cameras and track-plate boxes) (McKelvey et al. 2008). In its compilation of sightings of fishers, the USFWS assigned a numerical reliability rating *sensu amplo* (Aubry and Lewis 2003:81) to each fisher occurrence record as follows:

1. Specimens, photographs, video footage, or sooted track-plate impressions (records of high reliability that are associated with physical evidence);
2. Reports of fishers captured and released by trappers or treed by hunters using dogs (records of high reliability that are not associated with physical evidence);
3. Visual observations from experienced observers or from individuals who provided detailed descriptions that supported their identification (records of moderate reliability);
4. Observations of tracks by experienced individuals (records of moderate reliability);
5. Visual observations of fishers by individuals of unknown qualifications or that lacked detailed descriptions (records of low reliability);
6. Observations of any kind with inadequate or questionable description or locality data (unreliable records).

The Department adopted this rating system to estimate and map the current distribution of fishers in California and, as a conservative approach, considered only those locations assigned ratings of 1 and 2 to be “verified” records. Undoubtedly, reports of fishers assigned to other categories represent accurate observations, but when taken as a whole do not substantially change our understanding of the contemporary distribution of fisher populations in the state. To approximate the current range of fishers in California, observations of fishers with high reliability of 1 and 2 from 1993 to the present were mapped. Using GIS, those locations were overlaid on layers of forest cover and other layers of potential habitat (US Fish and Wildlife Service - Conservation Biology Institute habitat model), and buffered by 4 km to approximate the home range size of a male fisher. Polygons were drawn to incorporate most, but not all, of the buffered detections of fishers (Figure 4).

In California, fishers inhabit portions of the Coast Range, Klamath Mountains, southern Cascade Mountains, northern Sierra Nevada, and the southern Sierra Nevada. This estimate of current range is approximately 48% of the assumed historical range estimated by Grinnell et al. (1937). In northwestern California, fishers currently occupy much of their historical range, and may have expanded their range into the redwood region of coastal Humboldt and Del Norte counties. Fishers are seemingly absent from southern Mendocino county, southern Lake County, Sonoma, and Marin counties; evidence for their historic distribution in some of these areas is limited. Fishers also appear to be absent from the area east of Montague and north of Highway 97; Grinnell et al.(1937) reported a fisher was trapped in that area in the period spanning 1919-1924.

In the Sierra Nevada mountains, a number of broad scale, systematic surveys for fishers and other forest carnivores were conducted including from 1996 to 2002 (Zielinski et al. 2005:1392) and during 2002 to 2014(Zielinski et al. 2013*a*:8). At that time, fishers were not detected across an approximately 430 km (270 mi) region; from the southern Cascades (eastern Shasta County) to the southern Sierra Nevada (Mariposa County). Zielinski et al. (2005:1402–1403) expressed concern about this gap in their distribution primarily because it represented more than 4 times the maximum dispersal distance reported for fishers and put fishers in the southern Sierra Nevada at a greater risk of extinction, due to isolation, than if they were connected to other populations.

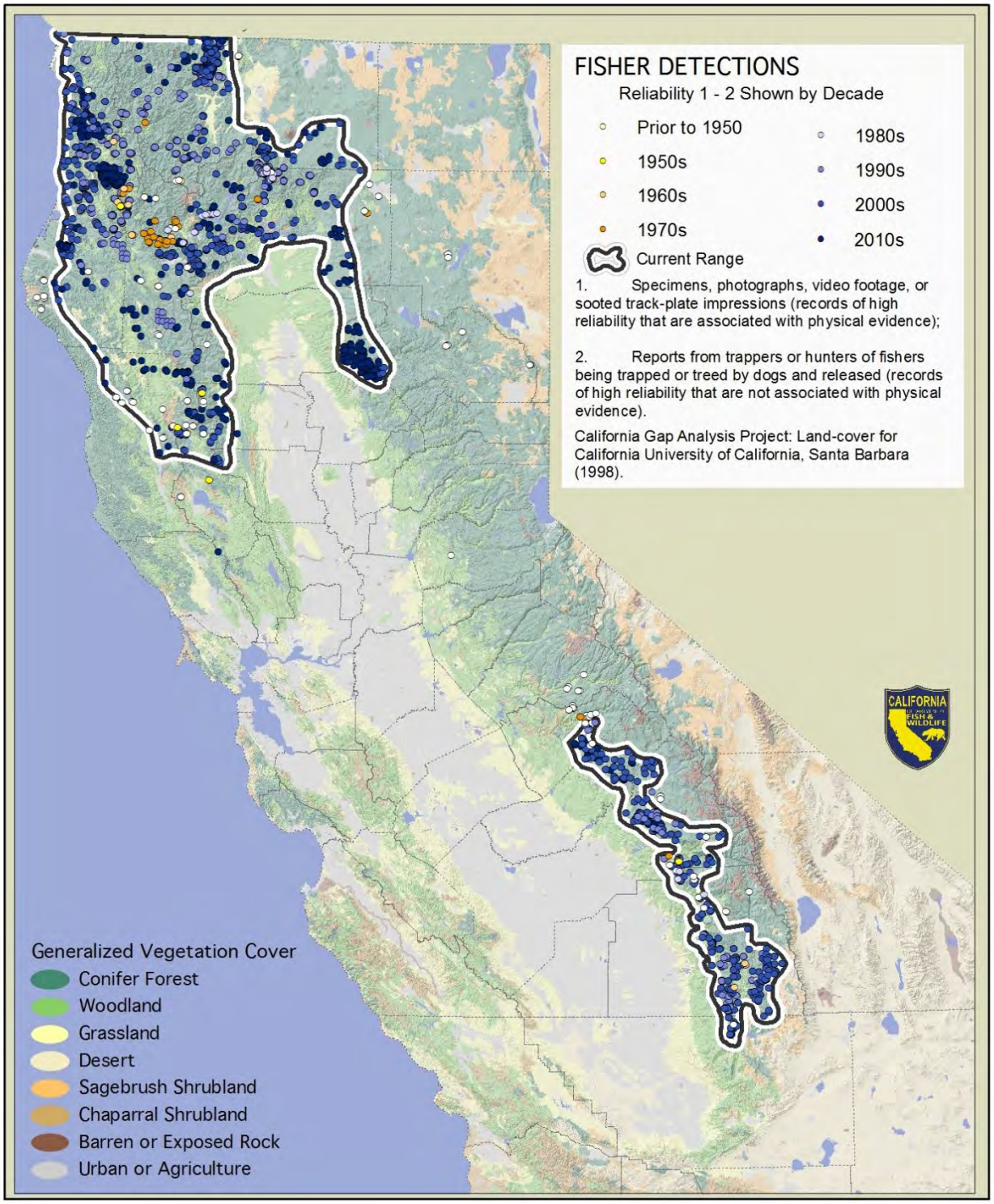

Figure 4. Locations of fishers detected in California by decade from 1950 through 2010 and estimated current range. Observations of fishers were compiled by the USFWS using information from the California Department of Fish and Wildlife's California Natural Diversity Database, federal agencies, private timberland owners, and others. Only observations assigned a reliability rating of 1 or 2 after Aubrey and Lewis (2003) were included. California Department of Fish and Wildlife, 2014.

Despite a number of extensive surveys using infrared-triggered cameras conducted by the Department, the US Department of Agriculture Forest Service (USFS), private timber companies, and others since the 1950s, no verifiable detections of fishers have been made in that portion of the Sierra Nevada bounded approximately by the North Fork of the Merced River and the North Fork of the Feather River (Zielinski et al. 1995, 2005).

Advances in genetic techniques have made it possible to estimate the length of time fishers in the southern Sierra Nevada have been isolated from other populations. This may indicate how long fishers have been absent or at low numbers within some portion or portions of the southern Cascades and northern Sierra Nevada and point to a long-standing gap in their distribution in California. Knaus et al. (2011) concluded that the absence of a shared haplotype between populations of fishers in northern and southern California and the degree of differentiation between haplotypes indicates they have been isolated for a considerable period. They hypothesized that this divergence could have occurred approximately 16,700 years ago, but acknowledged that absolute dates based on assumptions of mutation rates used in their study contain substantial and unknown error[29]. Despite this uncertainty, Knaus et al. (2011) concluded that three genetically distinct maternal lineages of fishers occur in California and their divergence likely predated modern land management practices.

Tucker et al. (2012:7, 8) used nuclear DNA from contemporary and historical samples from fishers in California and found evidence that fishers in northwestern California and the southern Sierra Nevada became isolated long before Euro-American settlement and estimated that the population declined substantially over a thousand years ago. This generally supports the conclusion of Knaus et al. (2011) that fishers in northern and southern portions of the state became isolated prior to Euro-American settlement. Tucker et al. (2012:8) also found evidence of a more recent population bottleneck in the northern and central portions of the southern Sierra Nevada and hypothesized that the southern tip of the range acted as a refuge for fishers from disturbance beginning with the Gold Rush through the first half of the 20th century. That portion of the range

[29] This estimate is also in conflict with that of Graham and Graham (1994), who estimated that fishers entered western forests within the past 5,000 years.

appeared to have maintained a stable population while the remainder of the southern Sierra Nevada population of fishers was in decline.

Since Euro-American settlement, the distribution of fishers in the southern Sierra Nevada has seemingly fluctuated. Currently, fishers are present from near the Merced River to the Kern River watershed. Specimens collected in the early 1900s indicate that fishers were present in the Tuolumne River drainage (north of the Merced) at that time. Genetic analyses and recent survey data suggest fisher range may have then contracted to south of the Kings River before expanding northward in recent decades to its current boundary at the Merced (Tucker et al. 2014:131). The fisher population in the southern Sierra Nevada is currently distributed in an elongated, narrow band of suitable habitat on a north-south axis composed of 4-5 core habitat areas divided by narrow corridors across river canyons (Spencer et al. 2015).

Life History

Reproduction and Development: Powell (1993:54, 57) suggested that fishers are polygynous (one male may mate with more than one female) and that males do not assist with rearing young. The fisher breeding season may vary by latitude, but generally occurs from February into April (Coulter 1966, Wright and Coulter 1967, Leonard 1986:39, Powell 1993:43). Females can breed at one year of age, but do not give birth until their second year (Eadie and Hamilton 1958, Powell 1993, Frost and Krohn 1997). They produce, at most, one litter annually and may not breed every year (Douglas and Strickland 1987, Paragi et al. 1994*a*). Reproductive frequency and success depend on a variety of factors including the availability of prey, male abundance, and the age and health of the female. Reproductive frequency likely peaks when females are 4-5 years old (Douglas and Strickland 1987, Arthur and Krohn 1991, Powell 1993, Paragi et al. 1994*a*).

Female fishers follow a typical mustelid reproductive pattern of delayed implantation of fertilized eggs after copulation (Douglas and Strickland 1987, Mead 1994, Frost et al. 1997). Implantation is delayed approximately 10 months (Wright and Coulter 1967) and occurs shortly before giving birth (parturition) (Frost et al. 1997). Arthur and Krohn (1991:381) considered the most likely functions of delayed implantation are to allow

mating to occur during a favorable time for adults and to maximize the time available for kits to grow before their first winter.

Active pregnancy follows implantation in late February for approximately 30 to 36 days (Powell 1993:53, Frost et al. 1997). Females give birth from about mid-March to early April (Truex et al. 1998, Aubry and Raley 2006, Higley and Matthews 2006, Self and Callas 2006, Weir and Corbould 2008) and breed approximately 6 to10 days after giving birth (Hall 1942:146, Powell 1993:53, Mead 1994). Ovulation is presumed to be induced by copulation (Powell 1993:47), with estrus lasting 2-8 days (Hall 1942:146). Therefore, adult female fishers are pregnant almost year round, except for the brief period after parturition (Powell 1993:53). Lofroth et al. (2010) presented a diagram that illustrates the reproductive cycle of fishers in western North America (Figure 5).

Based on observations of fishers in the wild, litter size range from 1 to 4 kits and averages from several studies range from 1.9 to 2.8 (Paragi et al. 1994*b*:6, York 1996:19, Aubry and Raley 2006:10, Matthews et al. 2013:103). Based on laboratory examination of corpora lutea[30] observed in harvested fishers, average litter size ranged from 2.3 to 3.7 kits (Eadie and Hamilton 1958, Wright and Coulter 1967, Kelly 1977, Leonard 1986, Douglas and Strickland 1987, Crowley et al. 1990, Weir 2003). However, these laboratory based averages may be artificially high. Counts of placental scars may provide a more accurate estimate of births than the number of corpora lutea (Powell 1993:53). Crowley et al. (1990) found that on average, 97% of females they sampled had corpora lutea, but only 58% had placental scars.

Raised in dens entirely by the female, young are born with their eyes and ears closed, their bodies only partially covered with sparse growth of fine gray hair, and weigh about 40 g (Hall 1942:147, Coulter 1966:81, Powell and Zielinski 1994:63). The kits' eyes open at 7-8 weeks old. They are completely dependent on milk until 8-10 weeks of age, after which time they are provided prey by their mother. They are capable

[30] The corpus luteum is a transient endocrine gland that develops from the follicle following ovulation and produces essentially progesterone required for the establishment and maintenance of early pregnancy (Bachelot and Binart 2005).

of killing their own prey at around 4 months of age (Powell 1993:62–70, Powell and Zielinski 1994:39, Aubry and Raley 2006:12). Juvenile females and males become sexually mature and establish their own home ranges at one year of age (Wright and Coulter 1967, Arthur et al. 1993). Some have speculated that juvenile males may not be effective breeders at one year due to incomplete formation of the baculum (Powell and Zielinski 1994). Due to delayed implantation, females must reach the age of two before being capable of giving birth and adult females may not produce young every year. The proportion of adult females that reproduce annually, reported from several studies in western North America, was 64% (range, 39% - 89%) (Lofroth et al. 2010:55). However, the methods used to determine reproductive rates (e.g., denning rates) varied among these studies and may not be directly comparable (Facka et al. 2013:10–15).

A recent study in the Hoopa Valley of California reported that 65% (55 of 85) of denning opportunities were successful in weaning at least one kit from 2005 to 2011 (Matthews et al. 2013). Of the female fishers of reproductive age translocated to private timberland in the southern Cascades and northern Sierra Nevada, an average of 78% (range, 63% -90%) gave birth to kits annually from 2010 to 2013 and 66% successfully weaned at least 1 kit (Facka, unpublished data). Reproductive rates may be related to age, with a greater proportion of older female fishers producing kits annually than younger female fishers (Lofroth et al. 2010:57, Matthews et al. 2013:103).

Many kits die immediately following birth. Frost and Krohn (1997) found in a captive population that average litter size decreased from 2.7 to 2.0 within a week of birth. Similarly, during a 3-year study of fishers born in captivity, 26% died within a week after birth (Frost and Krohn 1997). In wild populations, kits have been found dead at or near den sites and reproductive females have been documented abandoning their dens indicating their young had died (York 1996, Aubry and Raley 2006, Higley and Matthews 2006, Matthews et al. 2013:103). The number of fishers an individual female is able to raise until they are independent likely depends primarily upon food resources available to them. Paragi (1990) reported that fall recruitment of kits in Maine was between 0.7 and 1.3 kits per adult female. In British Columbia, average fall recruitment was estimated at 0.58 juveniles per adult female (Weir and Corbould 2008). In northwestern California, Matthews et al. (2013) estimated 0.19 juveniles per adult female were able to successfully establish a home range.

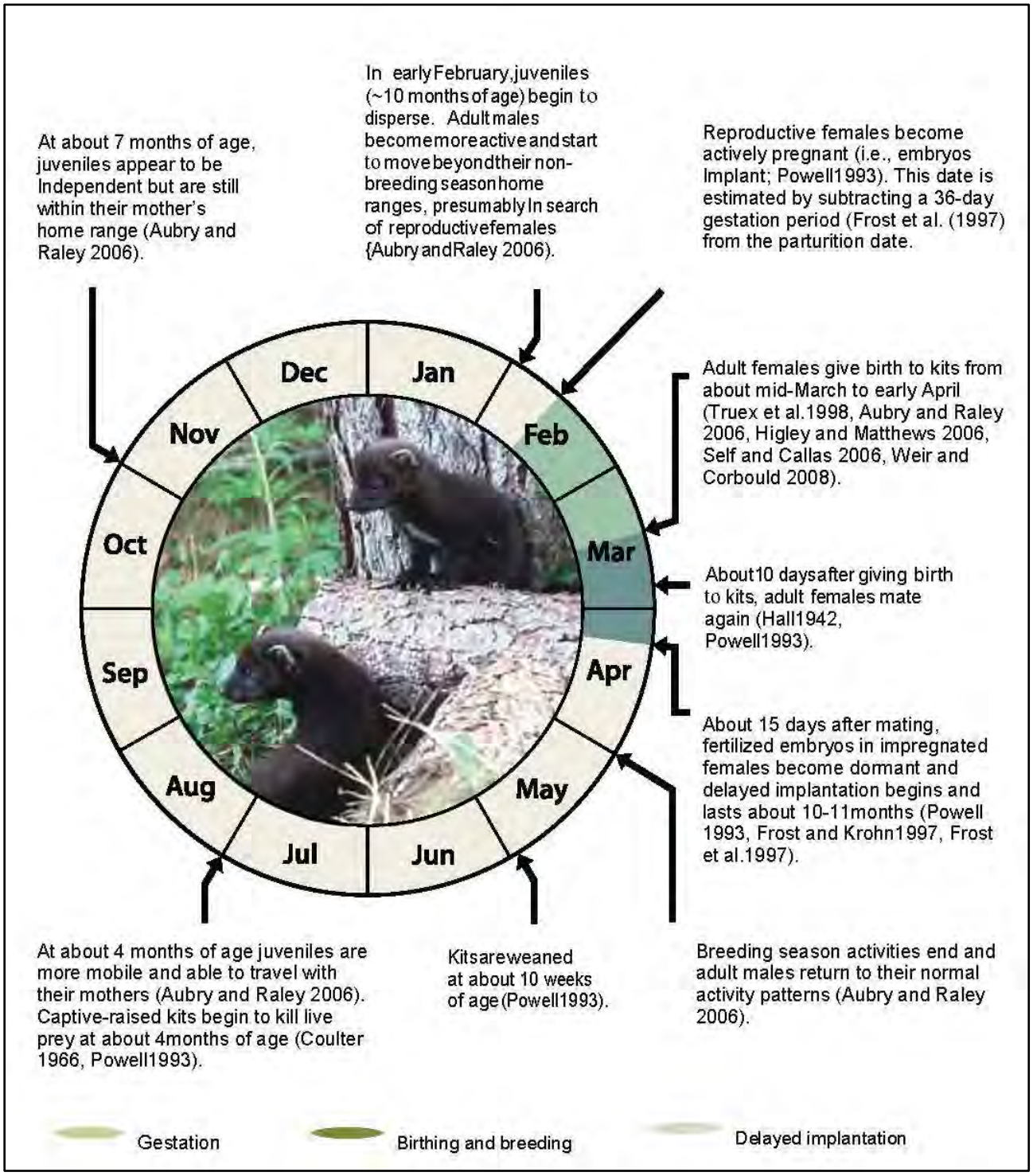

Figure 5. Reproductive cycle, growth, and development of fishers in western North America. From Lofroth et al. (2010).

Survival: There are few studies of longevity of fishers in the wild. Powell (1993:70–71) believed their life expectancy to be about 10 years, based on how long some individuals have lived in captivity and from field studies. Older individuals have been captured, but they likely represent a small proportion of populations. In British Columbia, Weir (2003:2) captured a fisher that was 12 years of age and, in California, a female fisher live-trapped and radio-collared in Shasta County gave birth to at least one kit at 10 years of age (Reno et al. 2008). Of 14,502 fishers aged by Matson's Laboratory using cementum annuli, the oldest individual reported was 9 years of age (Aging Experience, Accuracy and Precision n.d.).

In the wild, most fishers likely live far fewer years than their potential life span. Of 62 fishers captured in northern California, only 4 (6%) were older than 6 years of age and no individuals were older than 8 years (Brown et al. 2006, Reno et al. 2008). In northwestern California, 48 radio-collared fishers captured from 2004-2013 were monitored until they died; the average age at death across all years was 4.1 years for males and 4.8 years for females (Higley et al. 2013). The true age structures of fisher populations are not known because estimates are typically derived from harvested populations or limited studies, both of which have inherent biases due to differences in capture probabilities of fishers by age and sex class.

Estimated survival rates of fishers vary throughout their range (Lofroth et al. 2010:59). Factors affecting survival include commercial trapping intensity, density of predators, prey availability, rates of disease, road density, climatic conditions, habitat quality, and exposure to toxicants. Lofroth et al. (2010:62) summarized annual survival rates reported for radio-collared fishers in North America. They reported that anthropogenic sources of mortality accounted for an average of 21% of fisher deaths in western North America (documented by 8 studies), and averaged 68% (3 studies) in eastern Northern America. This difference was presumably due, in part, to the take of fishers by commercial trapping which is more widespread in eastern North America (e.g., Ontario, Maine, and Massachusetts).

In western North America, the overall average annual survival rate reported for three untrapped fisher populations was 0.74 (range, 0.61-0.84) for adult females and 0.82 (range, 0.73-0.86) for adult males (Lofroth et al. 2010:62). In the Hoopa Valley area, fisher survival between December 2004 and March 2013 was modeled using both

known fate and capture-mark-recapture (CMR) techniques (Higley et al. 2013:24). Both approaches yielded similar results. The known fate analysis for females indicated that annual survival began at 0.77, dropped to 0.60, and then rose to 0.826, while the CMR estimates showed apparent survival increasing from 0.73 to 0.82. Male known fate survival (5 years of data only) began at 1.0, dropped to 0.39, and then rose to 0.63, while the CMR estimate showed male survival beginning at 0.37 and ending at 0.46 (Higley et al. 2013:30). The top models for the known fate analysis showed lower average monthly survival for both sexes in May and June than any other months (Higley et al. 2013:25). A combined analysis using data from the Kings River Fisher Project and Sierra Nevada Adaptive Management Program study areas in the southern Sierra Nevada found annual adult female survival (0.72) was higher than that for males (0.64) (Sweitzer et al. In review*a*). Juvenile survival was 0.83 for females and 0.76 for males, and subadult (12-23 months of age) survival was 0.69 for both males and females. Survival was lower from March to August than September to February.

Food Habits: Fishers are generalist predators and consume a wide variety of prey, as well as carrion, plant matter, and fungi (Powell 1993:10). Since fishers hunt alone, the size of their prey is limited to what they are able to overpower unaided (Powell 1993:101). Understanding the food habits of fishers typically involves examination of feces (scats) found at den or rest sites, scats collected from traps when fishers are live-captured, or gastrointestinal tracts of fisher carcasses. Remains of prey often found at den sites can provide detailed information about prey species that may be otherwise impossible to determine by more traditional techniques (Lofroth et al. 2010).

In a review of 13 studies of fisher diets in North America by Martin (1994:309), five foods were repeatedly reported as important in almost all studies: snowshoe hare (*Lepus americanus*), porcupine (*Erethizon dorsatum*), deer, passerine birds, and vegetation. In western North America, fishers consume a variety of small and medium-sized mammals and birds, insects, and reptiles, with amphibians rarely consumed (Lofroth et al. 2010). The proportion of different food items in the diets of individual fishers differs presumably as a function of their experience and the abundance, catch-ability, and palatability of their prey (Powell 1993:100–101).

Studies indicate that fishers in California appear to consume a greater diversity of prey than elsewhere in western North America (Zielinski and Duncan 2004, Golightly et al.

2006, Lofroth et al. 2010). This difference may reflect an opportunistic foraging strategy or greater diversity of potential prey (Zielinski and Duncan 2004). Alternatively, the diversity of prey eaten by fishers may indicate that preferred prey is absent or at such low numbers that lower rank prey must be eaten (R. Powell, pers. comm.). Across their range, fishers prey predominately on the largest mammals they can consistently catch (e.g., porcupines, snowshoe hares, gray squirrels, carrion). Slauson and Zielinski (2012) reported that the home range size of fishers decreases as the relative frequency of larger mammalian prey (i.e., greater than 200 g (7 oz)) increases in their diet.

In northwestern California and the southern Sierra Nevada, mammals represent the dominant component of fisher diets, exceeding 78% frequency of occurrence in scats (Zielinski et al. 1999, Golightly et al. 2006). Prey items reported in these studies differed somewhat in frequency of occurrence and included insectivores (shrews, moles), lagomorphs (rabbits, hares), rodents (squirrels, mice, voles), carnivores (mustelids, canids), ungulates as carrion (deer and elk), birds, reptiles, and insects. Amphibian prey were only reported for northwestern California (Golightly et al. 2006), where they were found infrequently (<3%) in the diet. Fishers also appear to frequently consume fungi and other plant material (Grenfell and Fasenfest 1979:187, Zielinski et al. 1999:967).

In the Klamath/North Coast Bioregion of northern California, as defined by the California Biodiversity Council (Ca Biodiversity Council Bioregions (INACC Regions) - Data.gov n.d.), Golightly et al. (2006:17) found mammals to be the taxonomic group most frequently contained in fisher scats. Mammals identified most frequently included gray squirrels (*Sciurus griseus*), Douglas squirrels (*Tamiasciurus douglasii*), chipmunks (*Eutamias* sp.), northern flying squirrels (*Glaucomys sabrinus*), deer mice (*Peromyscus* sp), woodrats (*Neotoma* sp.), voles (*Microtus* sp.) and tree voles (*Arborimus* sp.). Other taxonomic groups found at high frequencies included birds, reptiles, and insects. Studies in both the Klamath/North Coast Bioregion and the southern Sierra Nevada have shown low occurrences of lagomorphs and porcupine in the diet (Zielinski et al. 1999, Zielinski and Duncan 2004, Golightly et al. 2006). This is likely due to the comparatively low densities of these species in ranges occupied by fishers in California compared to other parts of their range (Zielinski et al. 1999).

In the southern Sierra Nevada, Zielinski et al. (1999) reported that small mammals

constituted the majority of the diet of fishers, but insects and lizards were also frequently consumed. No animal family or plant group occurred in more than 22% of feces. In the southern Sierra Nevada, Zielinski et al. (1999) also noted that consumption of deer carrion increased from less than 5% in other seasons to 25% during winter months and the consumption of plant material increased with its availability in summer and autumn. Fishers also adapt their diet by switching prey when their primary prey is less available; consequently their diets vary based on what is seasonally available (Powell and Brander 1977, Powell et al. 1997, Zielinski et al. 1999, Golightly et al. 2006). Differences in the size and diversity of prey consumed by fishers among regions may reflect differences in the average body sizes of fishers and their ability to capture and handle larger versus smaller prey (Lofroth et al. 2010:76). These differences may also reflect the availability (abundance) of prey, predominant habitat, differences in weather, and abundance of other prey of similar mass (Golightly et al. 2006:37). At interior sites in northern California, Golightly et al. (2006:37) reported the relatively high consumption of squirrels and chipmunks compared to coastal sites. In coastal sites, the relative consumption of woodrats was higher, even though woodrats were available at both study sites.

The pronounced sexual dimorphism characteristic of fishers may also influence the types of prey they are able to capture and kill (Lofroth et al. 2010:76). This has been hypothesized as a mechanism that reduces competition between the sexes for food (Powell 1993:115, Weir et al. 2005:17). Males, being substantially larger than females, may be more successful at killing larger prey (e.g., porcupines and skunks) whereas females may avoid larger prey or be more efficient at catching smaller prey (Aubry and Raley 2006:27, Lofroth et al. 2010).

In a study of fisher diets in southern Sierra Nevada, Zielinski et al. (1999:965) found that during summer, the diet of female fishers contained a greater proportion of small mammals compared to the diet of male fishers. Deer remains in the feces of male fishers occurred much more frequently (11.4%) than in the feces of female fishers (1.9%). Weir et al. (2005) reported that the stomachs of female fishers contained a significantly greater proportion of small mammals compared to male fishers. Aubry and Raley (2006:25) found that female fishers consumed squirrels, rabbits and hares more frequently than male fishers and did not prey, or preyed infrequently, on some species found in the diets of male fishers (i.e., skunk, porcupine, and muskrat). Because most

scats from female fishers were collected at dens, the sample may have been biased towards smaller prey that could more easily be transported by females to dens and consumed by kits (Aubry and Raley 2006:27).

In some areas, male fishers have been found with significantly more porcupine quills in their heads, chests, shoulders, and legs than female fishers (Kelly 1977, Kuehn 1989). It is not known whether this difference reflects greater predation on porcupines by male fishers, female fishers being more adept at killing porcupines, or female fishers experiencing higher rates of mortality when preying on porcupines than male fishers (Powell 1993:115).

Habitat: Fishers use a variety of habitats throughout their range to meet their needs for food, reproduction, shelter, and protection from predation. Many studies have described habitats used by fishers, but most have focused on aspects of their life history related to resting and denning. This is due, in part, to the challenges of obtaining information about the activities of fishers when they are moving about compared to being in a fixed location such as a rest site or den. Some researchers (Grinnell et al. 1937:231, de Vos 1951:498, Hamilton et al. 1955, Powell 1979:199) have gained insight into the habitat use and movements of fishers by following their tracks in the snow.

Fishers in western North America have been consistently associated with low- to mid-elevation forested environments (Lofroth et al. 2010:85). The Department calculated the mean elevation of each Public Land Survey Section (The Public Land Survey System, n.d.) in which fishers were detected in California from 1993 to 2013. The grand mean of elevations at those locations was 1127 m (3698 ft) with 90% of the elevation means occurring between 275 m and 2197 m (902 ft and 7208 ft) (Figure 6). Habitats at higher elevations may be less favorable for fishers due to snow depth that may constrain their movements (Krohn et al. 1994), limited availability of den and rest structures, or limited prey (Raley et al. 2012:249). Fishers tend to occur at higher elevations in the southern Sierra Nevada than in northern California. On the Sequoia National Forest, near the southern end of the fisher's California range, they are most abundant between ≈1,830 – 2,140 m (6,000 – 7,000 ft) (Spencer et al. 2015:7).

Fishers use a variety of forest types in California, including redwood, Douglas-fir, Douglas-fir - tanoak, white fir, mixed conifer, mixed conifer-hardwood, and ponderosa

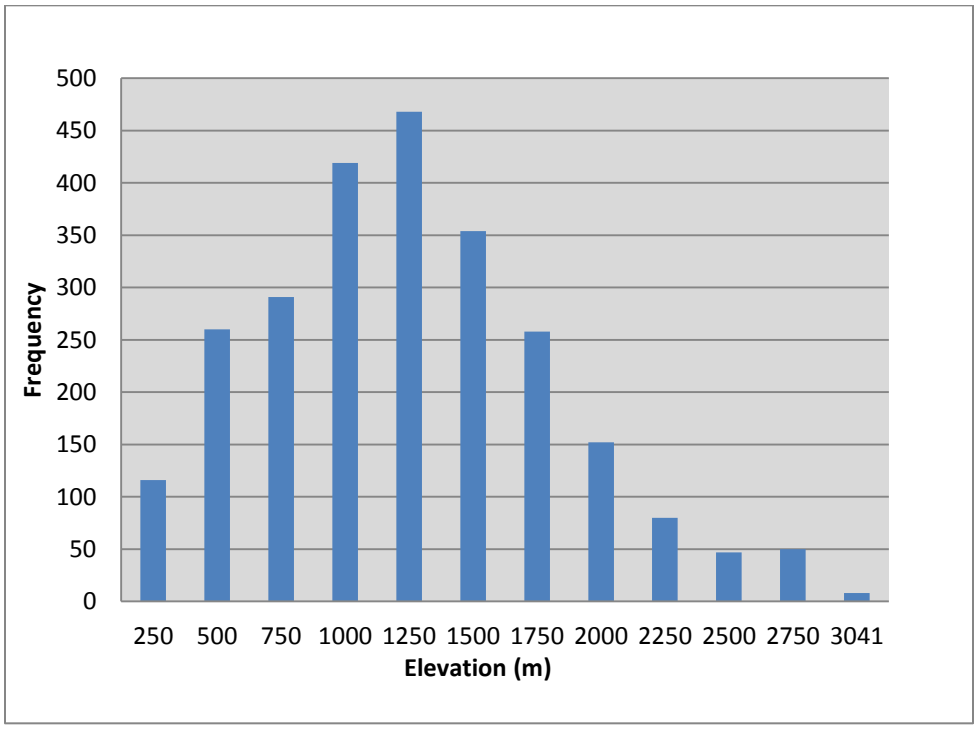

Figure 6. Mean elevations of Sections where fishers were observed (reliability ratings 1 and 2) in California from 1993 to 2013. California Department of Fish and Wildlife, 2014.

pine (Klug Jr 1997, Truex et al. 1998, Zielinski et al. 2004*a*). Hardwoods are more common in fisher home ranges in California than elsewhere in western North America (Lofroth et al. 2010:94). Tree species' composition may be less important to fishers than forest structural attributes that affect foraging success and provide resting and denning sites (Buskirk and Powell 1994). Forest canopy appears to be one of these components, as moderate and dense canopy is an important predictor of fisher occurrence at the landscape scale (Truex et al. 1998, Carroll et al. 1999, Zielinski et al. 2004*a*, Davis et al. 2007) and at the rest and den site scale (Powell and Zielinski 1994, Truex et al. 1998, Carroll et al. 1999, Zielinski et al. 2004*a*). Additional structural attributes considered beneficial to fishers at the stand and site scale include a diversity of tree sizes and shapes, canopy gaps and associated under-story vegetation, decadent structures (snags, cavities, fallen trees and limbs, etc.), and limbs close to the ground (Powell and Zielinski 1994).

Some researchers have hypothesized that fishers require old-growth conifer forests for survival (Buskirk and Powell 1994). However, habitat studies during the past 20 years

indicate that fishers do not depend on old-growth forests, provided adequate canopy cover, large structures for reproduction and resting, vertical and horizontal escape cover, and sufficient prey are available (Raley et al. 2012:248). Raley et al. (2012) suggested that the most consistent characteristic of fisher home ranges is that they contain a mixture of forest plant communities and seral stages which often include relatively high proportions of mid- to late-seral forests, but low proportions of open or nonforested environments.

In the southern Sierra Nevada fisher home ranges include a mosaic of forest successional stages, however, areas of mature forest within home ranges have been considered necessary to provide prey, rest sites, and den sites (Spencer et al. 2015:29). In the coastal redwood region, Slauson and Zielinski (2003:7) detected fishers at track plate stations in old growth significantly less than expected, and in second growth redwood forests significantly more than expected. Within these second growth forests, however, they detected fishers in the oldest age stands that had higher densities of medium and large deadwood structures, including snags, stumps, and downed logs.

Studies of habitats used by fishers when they are away from den or rest sites in western North America are rare; most methods employed have not allowed researchers to distinguish among behaviors such as foraging, traveling, or seeking mates. Where these studies have been conducted, active fishers were associated with complex forest structures (Raley et al. 2012:241). Raley et al. (2012:241) reviewed several studies (Carroll et al. 1999, Slauson et al. 2003, Weir and Harestad 2003, Campbell 2004) and reported that active fishers were generally associated with the presence, abundance, or greater size of one or more of the following: logs, snags, live hardwood trees, and shrubs. Although complex vertical and horizontal structures appear to be important to active fishers, overarching patterns of habitat use or selection have not been demonstrated (Raley et al. 2012:241). The lack of strong habitat associations for active fishers may be influenced by the limitations of most methods used to study fishers in distinguishing among behaviors such as foraging, traveling, or seeking mates that may be linked to different forest conditions (Raley et al. 2012:241).

During periods when fishers are not actively hunting or traveling, they use structures for resting, which may serve multiple functions including thermoregulation, protection from predators, and as a site to consume prey (Lofroth et al. 2010:72, Aubry et al. 2013).

Raley et al. (2012:240) analyzed more than 2,260 rest structures documented in studies from 12 geographic regions in western North America and found the characteristics of the structures to be “overwhelmingly consistent”. Fishers primarily rested in deformed or deteriorating live trees and to a lesser extent in snags and logs (Raley et al. 2012:240, Green et al. 2013). Live trees, snags, and logs used by fishers for resting are generally much larger than the average size of structures available (Weir and Harestad 2003:78; Zielinski et al. 2004b:485; Purcell et al. 2009:2703). However, fishers were also documented using trees and logs with relatively small diameters indicating large diameter structures may not be essential (Zielinski et al. 2004*b*:485, Purcell et al. 2009:2703).

The species of tree or log used for resting appears less important than the presence of a suitable microstructure in which to rest (e.g., a cavity or, platform) (Raley et al. 2012:240). Microstructures used by fishers for resting include platforms formed as a result of fungal infections, nests or woody debris, cavities in trees or snags, and logs or debris piles created during timber harvest operations (Zielinski et al. 2004b:479, 482; Yaeger 2005:21; Aubry and Raley 2006:20; Weir and Corbould 2008:103; Purcell et al. 2009; Green et al. 2013)(Aubry and Raley 2006:20)(K. B. Aubry and Raley 2006, 20)(K. B. Aubry and Raley 2006, 20). Rest structures appear to be reused infrequently by the same fisher (Stephen M. Arthur et al. 1989:683, Seglund 1995:44, Zielinski et al. 2004*b*:68, Purcell et al. 2009:2700). In southern Oregon, Aubry and Raley (2006:17) located 641 resting structures used by 19 fishers and only 14% were reused by the same animal on more than one occasion. In the southern Sierra Nevada, Purcell et al. (2009) documented the reuse of rest sites on only 4 of 82 occasions (5%). However, in northwest Connecticut, Kilpatrick and Rego (1994:1418) reported that 10% of summer and 24% of all winter rest sites were reused. Of those, seven were located near scavenged carcasses and four were either in or near dens used by porcupines, perhaps indicating that fishers reuse rest sites where they have access to larger food items than can be consumed in one meal.

Studies of rest sites used by fishers based on locations of animals equipped with transmitters may have a bias that is seldom mentioned (R. Powell pers. comm.). Signals from transmitters worn by fishers when resting in trees are generally stronger and more likely to be received by researchers and found compared to rest sites in logs, piles of brush, or underground. It is also possible that rest sites at ground level or in

small trees may be more likely to be abandoned by fishers when approached by researchers than when fishers are resting in large trees and high above the ground. This potential bias could skew the findings of some studies of rest sites toward larger structures which may be easier to locate.

A meta-analysis conducted by Aubry et al. (2013) of 8 study areas from central British Columbia to the southern Sierra Nevada found that fishers selected rest sites in stands that had steeper slopes, cooler microclimates, denser overhead cover, a greater volume of logs, and a greater abundance of large trees and snags than random sites. Live trees and snags used by fishers are, on average, larger in diameter than available structures (see review by Raley et al. (2012:240)). Fishers frequently rest in cavities in large trees or snags and it may require considerable time (greater than 100 years) for suitable microstructures to develop (Raley et al. 2012:240).

The types of den structures used by fishers have been extensively studied. Female fishers have been reported to be obligate cavity users for birthing and rearing their kits (Raley et al. 2012:238). Hollow logs are also occasionally used for reproduction (i.e., maternal dens) (Aubry and Raley 2006:16). Grinnell et al. (1937:226, 227) reported observations of a fisher with young that denned under a large rocky slab in Blue Canyon in Fresno County. Both conifers and hardwood trees are used for denning and the frequency of their use varies by region; the available evidence indicates that the incidence of heartwood decay and development of cavities is more important to fishers than the species of tree (Raley et al. 2012:239) (Figure 7).

In the Kings River Fisher Project and Sierra Nevada Adaptive Management Program study areas, California black oaks are the most common tree species used for denning (54% and 43% of all dens, respectively) (R. Green, unpublished data; R. Sweitzer, unpublished data; cited by Spencer et al. (2015)). Dens used by fishers must shelter kits from temperature extremes and potential predators. Females may choose dens with openings small enough to exclude potential predators and aggressive male fishers (Raley et al. 2012:239).

Measurements of the diameter of trees used by fishers for reproduction indicate they were consistently among the largest available in the vicinity and were 1.7-2.8 times

Figure 7. Fishers frequently shelter their young within cavities in live trees. These images depict examples of trees with cavities used by fishers for denning (left photo Douglas-fir den tree climbed by wildlife technician Matt Palumbo: photo credit J. M. Higley, Hoopa Tribal Forestry; right photo black oak den tree climbed by CDFW Environmental Scientist Pete Figura: photo credit Richard Callas.

larger in diameter on average than other trees in the vicinity of the den [Paragi (1990, 2003, 2008), as cited by Raley et al. (2012:238)]. Conifers and hardwoods used for dens in the southern Sierra Nevada are large; 75% of conifers used for dens equaled or exceeded 89 cm (35 in) dbh[31] in the Kings River Fisher Project and equaled or exceeded 94 cm (37 in) in dbh in the Sierra Nevada Adaptive Management Program study. Seventy-five percent of the oaks used for dens equaled or exceeded 63 cm (25 in) dbh in both studies. Depending on the growing conditions, considerable time is

[31] dbh refers to tree diameter at breast height, 1.4 m (4.5 ft).

needed for trees to attain sufficient size to contain a cavity large enough for a female fisher and her kits.

Information collected from more than 330 dens used by fishers for reproduction indicated that most cavities used were created by decay caused by heart-rot fungi (Reno et al. 2008, Weir and Corbould 2008, Davis 2009). Infection by heart-rot fungi is only initiated in living trees (Bull et al. 1997) and must occur for a sufficient period of time in a tree of adequate size to create microstructures suitable for use by fishers. This process is important for fisher populations as female fishers use cavities exclusively for dens (Raley et al. 2012:238). Although we are not aware of data on the ages of trees used for denning by fishers in California, Douglas-fir trees used for dens in British Columbia averaged 372 years in age (Davis 2009).

A number of habitat models have been developed to rank and depict the distribution of habitats potentially used by fishers in California (Carroll et al. 1999, Davis et al. 2007, CDFW 2008, Zielinski et al. 2010). The newest model of landscape scale habitat selection was developed by the USFWS and the Conservation Biology Institute (USFWS-CBI model) to characterize fisher habitat suitability throughout California, Oregon, and Washington. In California, the USFWS-CBI model consisted of 3 different sub-models by region. Where these regions overlapped the models were blended together using a distance-weighted average.

The USFWS-CBI models described the probability of fisher occurrence (or potential habitat quality) using Maxent (version 3.3.3k) (Phillips et al. 2006), based on 456 localities of verified fisher detections since 1970, and an array of 22 environmental data layers including vegetation, climate, elevation, terrain, and Landsat-derived reflectance variables at 30-m and 1-km resolutions (W. Spencer and H. Romsos, pers. comm.). The majority of the fisher localities used were from California, and included points from northwestern California and the southern Sierra Nevada. The environmental variables were systematically removed to create final models with the fewest independent predictors.

For the southern Sierra Nevada and where it blended into the central and northern Sierra Nevada, the variables used in the USFWS-CBI model were basal-area-weighted

canopy height, minimum temperature of the coldest month, tassel-cap greenness[32], and dense forest (percent of forest with 60% or more canopy cover). In the Klamath Mountains and Southern Cascades and where the model blended into the northern Sierra Nevada, the model variables used were tassel-cap greenness, percent conifer forest, latitude-adjusted elevation, and percent slope. Within the Coast Range and where the model blended into the Klamath Mountains, model variables used were total above-ground biomass, mean temperature of the coldest quarter, isothermality, maximum temperature of the warmest month, and percent slope.

The USFWS-CBI model is emphasized here because of its explicit emphasis on modeling habitat throughout California, its use of a large number of detections from throughout occupied areas in California, and a large number of environmental variables, some of which were not available for use in earlier modeling efforts. Other recent models (Carroll et al. 1999, Zielinski et al. 2010) have primarily been focused on predicting habitat in the northwestern part of California or have been derived from far fewer fisher detections (Davis et al. 2007).

The final USFWS-CBI model provides a spatial representation of probability of fisher occurrence or potential habitat suitability using 3 categories. Habitat considered to be preferentially used by fishers was rated as “high quality,” model values associated with habitats avoided by fishers were designated as “low quality,” and habitats that were neither avoided nor selected were considered “intermediate.” The “low quality” habitat category may include non-habitat (not used) as well as other habitats used infrequently relative to their availability by fishers. The Department considered the USFWS-CBI model to be the best information available depicting the amount and distribution of habitats potentially suitable for fishers within the historical range depicted by Grinnell et al. (1937) and the species’ current range in California. Based on the USFWS-CBI model, approximately 74% of the NC ESU supports habitat predicted to be of intermediate or high value for fishers. This percentage is slightly higher (about 77%) for habitats of intermediate or high value for fishers within the SSN ESU (Figures 8 and 9).

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[32] Tassel-cap greenness is a measure from LANDSAT data generally related to primary productivity (i.e. the amount of photosynthesis occurring at the time the image was captured) (K. Fitzgerald, pers. comm.).

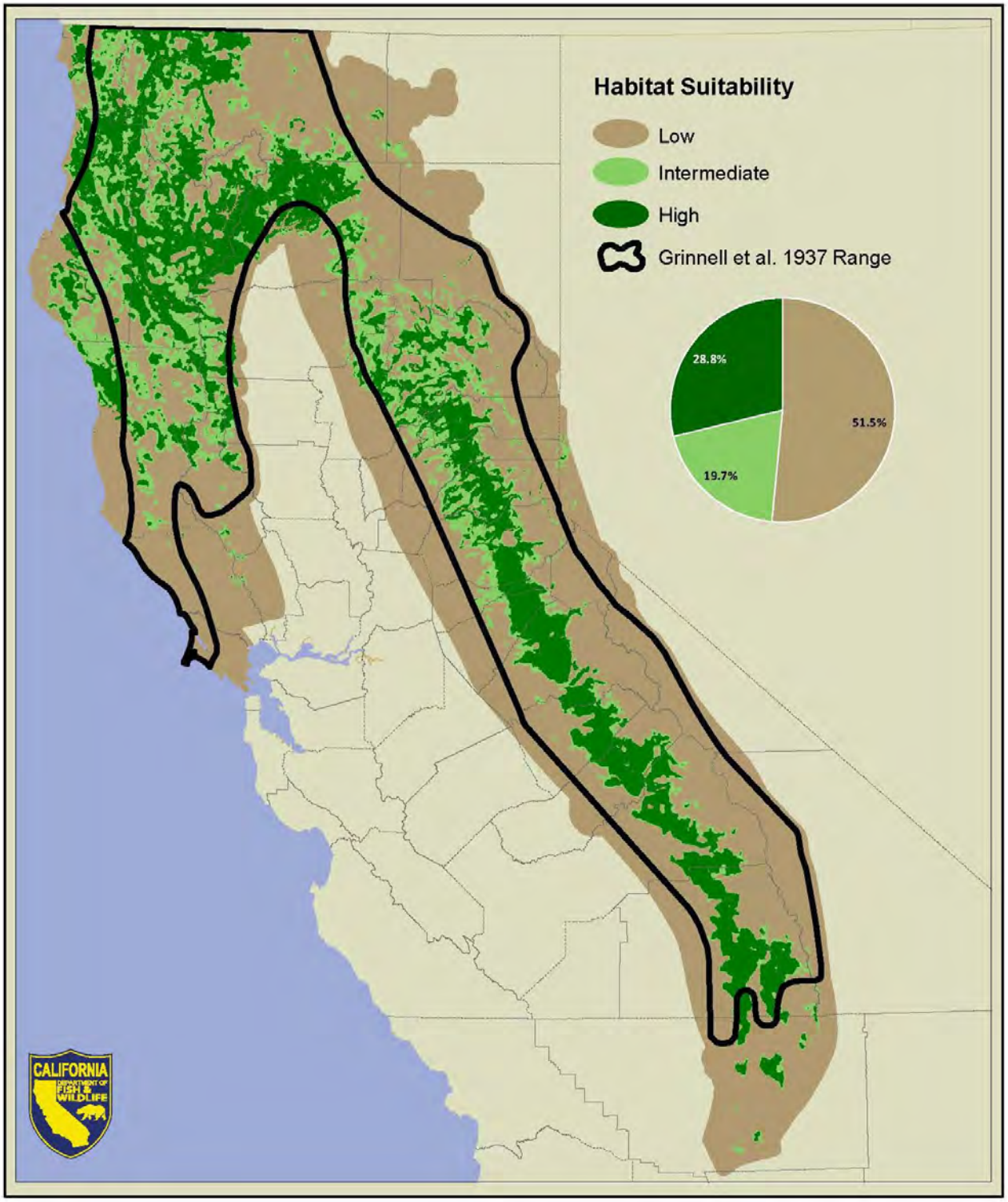

Figure 8. Summary of predicted habitat suitability within the historical range depicted by Grinnell et al. (1937). Habitat suitability was predicted using a model developed by the Conservation Biology Institute and the US Fish and Wildlife Service, 2014.

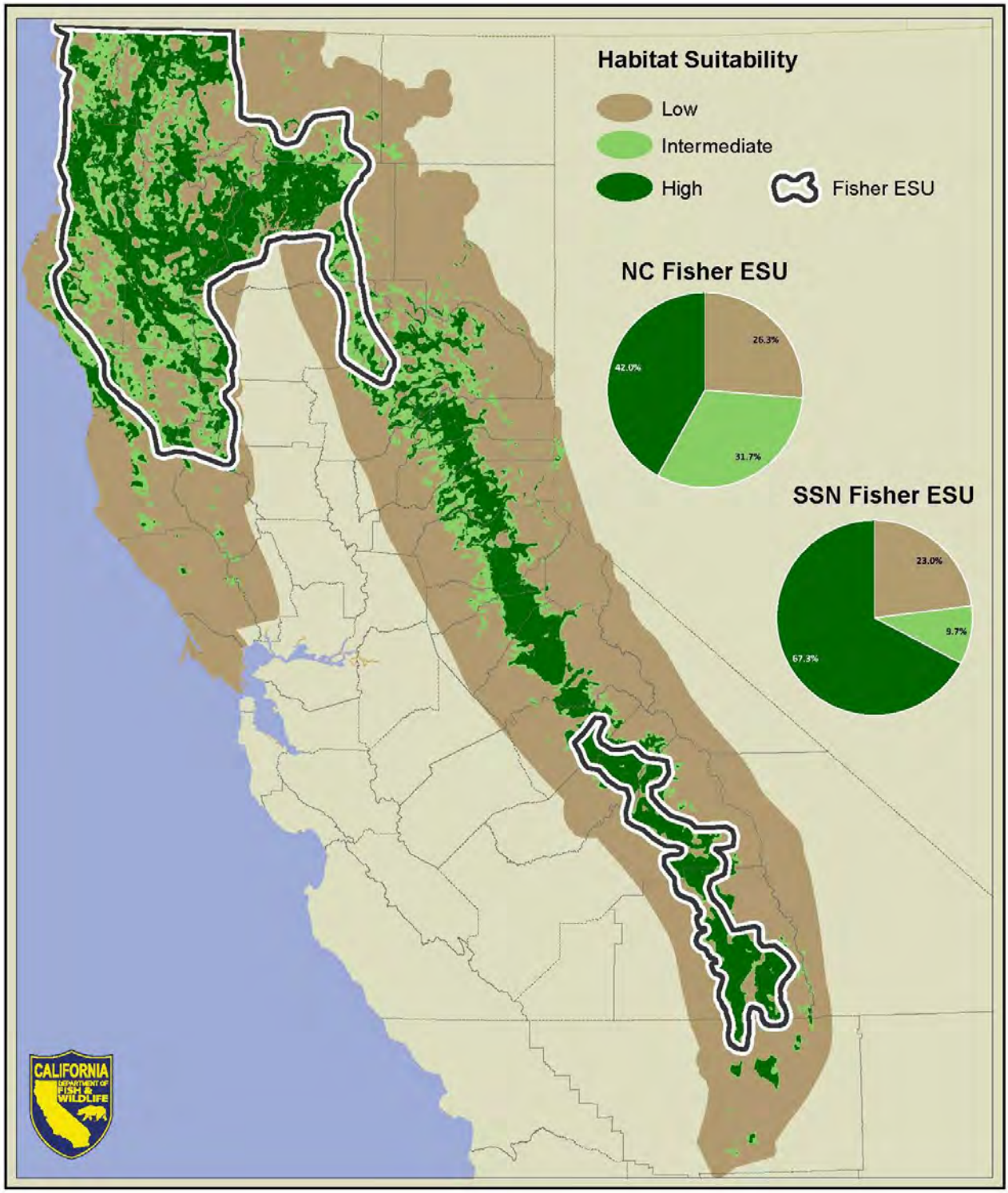

Figure 9. Summary of predicted habitat suitability within the Northern California Fisher Evolutionarily Significant Unit (NC ESU) and the Southern Sierra Nevada Evolutionarily Significant Unit (SSN ESU). Habitat suitability was predicted using a model developed by the Conservation Biology Institute and the US Fish and Wildlife Service, 2014.

Home Range and Territoriality: A home range is commonly described as an area which is familiar to an animal and used in its day-to-day activities (Burt 1943). These areas have been described for fishers and vary greatly in size throughout the species' range and between the sexes.

Fishers are largely solitary animals throughout the year, except for the periods when males accompany females during the breeding season or when females are caring for their young (Powell 1993:166). The home ranges of male and female fishers may overlap, however, the home ranges of adults of the same sex typically do not (Powell 1993:172, Powell and Zielinski 1994:59). A male fisher's home range may overlap those of multiple females with the potential benefit of increased reproductive success (Powell 1993:172).

Lofroth et al. (2010:68) summarized 14 studies that provided estimates of the home range sizes of fishers in western North America. On average across those studies, home range sizes were 18.8 km^2 (7.3 mi^2) for females and 53.4 km^2 (20.6 mi^2) for males. In the southern Sierra Nevada, the Sierra Nevada Adaptive Management Project study found that annual adult male home range size averaged 86 km^2 (33 mi^2) and annual female home range size averaged 23 km^2 (9 mi^2), while in the Kings River Project area mean annual adult home ranges of males and females averaged 45 km^2 (17 mi^2) and 11 km^2 (4 mi^2), respectively (Thompson et al. 2010:24, Spencer et al. 2015:18–19).

In 9 studies in western North America the home range sizes of male fishers averaged approximately 3 times larger than the home range sizes of female fishers (Lofroth et al. 2010:68). The variation in home range estimates among studies was due, in part, to differences in sampling effort and analytical methods, making comparisons difficult among geographic regions or studies (Lofroth et al. 2010:67). Nevertheless, differences in home range size, with male fishers using substantially larger areas than females, has been consistently reported (Kelly 1977, Buck et al. 1983, Johnson 1984, S. M. Arthur et al. 1989, Jones 1991, York 1996, Garant and Crete 1997, Zielinski et al. 2004*a*, Yaeger 2005, Aubry and Raley 2006, Koen et al. 2007, Weir and Corbould 2008, Popescu et al. 2014). Lofroth et al. (2010) noted that home range sizes of fishers generally increase from southern to northern latitudes.

Dispersal: Dispersal is a term that describes the movements of animals away from the site where they are born. These movements are typically made by juvenile animals and have been pointed out by Mabry et al. (2013) as increasingly recognized to occur in three phases: 1) departing from the natal[33] area; 2) searching for a new place to live; and 3) settling in the location where the animal will breed. The length of time and distance a juvenile fisher travels to establish its home range is influenced by a number of factors including its sex, the availability of suitable but unoccupied habitat of sufficient size, ability to move through the landscape, prey resources, turnover rates of adults (Arthur et al. 1993, York 1996, Weir and Corbould 2008:34) and perhaps competition with other juveniles seeking to establish their own home ranges.

Dispersing juvenile fishers are capable of moving long distances and traversing rivers, roads, and rural communities (York 1996, Aubry and Raley 2006:10, Weir and Corbould 2008). During dispersal, juveniles likely experience relatively high rates of mortality compared to adult fishers from predation, starvation, accident, and disease due to traveling through unfamiliar and potentially unsuitable habitat (Douglas and Strickland 1987, Powell 1993, Strickland 1994, Weir and Corbould 2008:14). Dispersal in mammals is often sex-biased, with males dispersing farther or more often than females (Mabry et al. 2013). This pattern appears to hold true for fishers (Aubry et al. 2004:201, Aubry and Raley 2006:14, Matthews et al. 2013:105, Tucker 2013*a*). It may result from the willingness of established males to allow juvenile females, but not other males, to establish home ranges within their territories (Aubry et al. 2004:205). Because females generally establish territories closer to their natal areas, the risks associated with dispersal through unknown areas are minimized and their territories are closer to those areas where resources have proven sufficient (Greenwood 1980, Stephen Dobson 1982).

Juvenile fishers generally depart from their natal area in the fall or winter (November through February) when they exceed 7 months of age (Lofroth et al. 2010:72). In some studies, juvenile male fishers departed from their natal ranges earlier than females (Matthews et al. 2013:105). Where suitable, unoccupied habitat is unavailable, juveniles may be forced into longer periods of transiency before establishing home

[33] Natal refers to the place of birth.

ranges. This behavior is characterized by higher mortality risk (Weir and Corbould 2008:48).

Understanding dispersal in fishers and many other species of mammals is challenging due to the difficulty of capturing and marking young at or near the site where they were born, concerns over equipping juvenile animals with telemetry collars or implants, difficulties associated with locating actively dispersing animals, and the comparatively high rates of juvenile mortality. Studies that have been able to follow dispersing juvenile fishers until they establish home ranges are relatively rare. Direct comparison of the results of these studies is difficult because various methods have been used to calculate dispersal distances. In eastern North America, Arthur et al. (1993:871), reported mean maximum dispersal distances for male and female fishers of 17.3 km (10.7 mi) and 14.9 km (9.3 mi), respectively. Also in eastern North America, York (1996:56) reported a mean maximum dispersal distance for males of 25 km (15.5 mi) and mean maximum dispersal distance of 37 km (23 mi) for female fishers. The greater dispersal distance for females compared to males reported by York is unusual as, in other studies, males dispersed farther than females. Matthews et al. (2013:104), reported that the average maximum distance from natal dens to the most distant locations documented for juvenile fishers was greater for males [8.1 km (5.0 mi)] than for females [6.7 km (4.2 mi)].

In the interior of British Columbia, Weir and Corbould (2008:44), reported dispersal distances from the centers of natal to the centers of established home ranges of 0.7 km (0.4 mi) and 32.7 km (20.3 mi) for two female fishers and 41.3 km (15.9 mi) for one male fisher. In the southern Oregon Cascade Range, Aubry and Raley (2006:14) reported mean dispersal distances from capture locations to the nearest point of post-dispersal home ranges for male and female fishers of 29 km (18 mi) and 6 km (3.7 mi), respectively. In northern California on the Hoopa Valley Indian Reservation, Matthews et al. (2013:104) reported the distance between natal dens to the centroids (geometric center) of home ranges established by a single male fisher of 1.3 km (0.82 mi) and for 7 female fishers to average 4.0 km (2.5 mi).

At the Sierra Nevada Adaptive Management Program study site in the southern Sierra Nevada, 20 juvenile female fishers dispersed an average of 4.9 km (3.0 mi) and 15 juvenile males dispersed an average of 6.9 km (4.4 mi) (Spencer et al. 2015:20). Within

this study area 55% (11 of 20) of juvenile female and 40% (6 of 15) of juvenile male fishers exhibited no or limited dispersal movements and established adult home ranges near their natal home ranges (R. Sweitzer, unpublished data, cited by Spencer et al. 2015:20). One male fisher dispersed moved 36 km (22 mi) from the Kings River Project study area to the Sierra Nevada Adaptive Program study area (Spencer et al. 2015:20). In the southern Sierra Nevada, Tucker et al. (2013a:70–71) modeled dispersal in fishers and speculated that landscape features (i.e., dense forest, roads, water) have much less influence on gene flow for males compared to females, indicating that male fishers may cross these potential barriers more readily than female fishers.

Habitat that May be Essential for the Continued Existence of the Species

Fishers have generally been associated with forested environments throughout their range by early trappers and naturalists (Price 1894:331, Grinnell et al. 1937:214) and researchers in modern times (De Vos 1952:12, Powell 1993:18, 76, Buck et al. 1994:373–375, Jones and Garton 1994:383, Powell and Zielinski 1994:39, Weir and Corbould 2010:408). Yet, the size, age, structure, and scale of forests essential for fishers are less clear. Fishers have been considered to be among the most habitat specialized mammals in North America and were hypothesized to require particular forest types (e.g., old-growth conifers) for survival (Buskirk and Powell 1994:296). However, studies of fisher habitat use over the past two decades demonstrate that fishers do not depend on old-growth forests *per se*, nor are they associated with any particular forest type (Raley et al. 2012:248). At finer spatial scales, fishers are associated with structurally complex forests containing large trees, logs, and with moderate-to-dense canopy cover (Raley et al. 2012:251).

Fishers are found in a variety of low- to mid-elevation forest types (Hagmeier 1956, Banci 1989, Powell 1994, Weir and Harestad 2003, Spencer et al. 2011) that typically are characterized by a mixture of forest plant communities and seral stages, often including relatively high proportions of mid- to late-seral forests (Raley et al. 2012:248). These landscapes are suitable for fishers if they contain adequate canopy cover, den and rest structures of sufficient size and number, vertical and horizontal escape cover, and prey (Raley et al. 2012:248). Despite considerable research on the characteristics of habitats used by fishers, quantitative information is lacking regarding the number and

spatial distribution of suitable den and rest structures needed by fishers and their relationship to measures of fitness such as reproductive success.

Trees with suitable cavities are important to female fishers for reproduction. These trees must be of sufficient size to contain cavities large enough to house a female with young (Weir and Corbould 2008:155). Aubry and Raley (2006:16) reported that the sizes of den entrances used by female fishers were typically just large enough for them to fit through and hypothesized that size of the opening may exclude potential predators and perhaps male fishers. In contrast, Weir (2008:157) found that female fishers did not appear to select den entrances of a size to exclude potentially antagonistic male fishers. Studies have shown that trees used by fishers for denning are among the largest available in the vicinity (Reno et al. 2008, Weir and Corbould 2008, Davis 2009).

Habitats used by fishers in western North America are linked to complex ecological processes including natural disturbances that create and influence the distribution and abundance of microstructures for resting and denning (Raley et al. 2012:242). These include wind, fire, tree pathogens, and primary excavators important to the formation of cavities or platforms used by fishers. Trees used by fishers for denning or resting are typically large and considerable time (>100 years) is required for most suitable cavities to develop (Raley et al. 2012:240). Comparatively little is known of the foraging ecology of fishers, in part, due to the difficulty of obtaining this information. Nevertheless, forest structure important for fishers should support high prey diversity, high prey populations, and provide conditions where prey are vulnerable to fishers.

Species Status and Population Trends

Distribution Trend

Comparing the historical range of fishers in California estimated by Grinnell et al. (1937) to the distribution of more recent detections of fishers, it appears that their range has contracted by approximately 48%. This conclusion is largely based on contemporary surveys indicating that fishers are absent in the central and northern portions of the Sierra Nevada and rare or absent from portions of Mendocino, Lake, Sonoma, and Marin counties. Despite extensive surveys from 1989-1995 (Zielinski et al. 1995) and 1996-2002 (Zielinski et al. 2005) for fishers from the southern Cascades (eastern Shasta County) to the central Sierra Nevada (Mariposa County), none were detected. However, these surveys were conducted at a broad scale and the authors point out that the species targeted were not always detected when present and that some areas that may have been occupied were not sampled. Support for Grinnell et al.'s (1937) inclusion of portions of southernmost Mendocino, Sonoma, and Marin counties within the map of the fisher's "assumed general range within past seventy-five years" appears to have been based primarily on two anecdotal sighting reports[34]. By the 1930s Grinnell et al. seemingly believed fishers no longer to be present in those areas, writing "the fisher is found at the present time [presumably referring to 1937] coastwise from the Oregon line south to southern Mendocino County" (Grinnell et al. 1937:219). Therefore, it is not clear that the contemporary absence of fishers in those areas represents a range contraction.

Recent genetic analyses indicate that the fishers in northwestern California and the southern Sierra Nevada have been genetically isolated from each other for hundreds, if not thousands, of years (Knaus et al. 2011, Tucker et al. 2012). It has thus been suggested that the current "gap" in the distribution of fishers in the Sierra has been long standing and that, contrary to the assertions of Grinnell et al. (1937), fishers did not occur throughout the Sierra at the time of Euro-American settlement (Knaus et al. 2011, Tucker et al. 2012, Tucker 2013*a*). This interpretation is bolstered by the lack of

[34] In one case, in 1913 a resident of Point Reyes "reported that a fisher was active three miles west of Inverness." In the other undated anecdote, a long term resident of Fort Ross "knew of the presence of fishers in that locality in previous years."

museum specimens from the Sierra north of the Tuolumne River. However, it is challenged by substantial anecdotal evidence that fishers were present in the central and northern Sierra and southernmost portions of the Cascades through the 1920s and possibly as late as the 1940s (Price 1894, James 1915, Winter vs. summer furs. 1917, Butler 1920, Durbin 1925, Grinnell et al. 1937, Schempf and White 1977). One possible interpretation of the incongruous genetic and anecdotal distribution data is that fishers historically occurred in the area of the gap, but their distribution was discontinuous. Landscape features relatively resistant to fisher movement (e.g., the numerous east-west trending Sierra river canyons, often with steep, rocky slopes and non-forested vegetation) may have promoted a discontinuous distribution and, in sum, minimized or precluded genetic exchange between fisher populations in northwestern California and the southern Sierra Nevada.

Since the 1990s, detections of fishers appear to have increased along the western portions of Del Norte and Humboldt counties, in Mendocino County, and in southeastern Shasta County. It is unknown if these relatively recent detections represent range expansions due to habitat changes, the recolonization of areas where local populations of fishers were extirpated by trapping, or if they were present, but undetected by earlier and less extensive surveys. Some fishers, or their progeny, released in Butte County as part of a reintroduction effort have also been documented in eastern Shasta, Tehama, and western Plumas counties.

In the southern Sierra Nevada, the results of surveys for fishers suggest a relatively recent population expansion. In the 1990s through the early 2000s, fishers were rarely detected in northern portions of the SSN ESU compared to surveys conducted from 2006 to 2009 where fishers were detected considerably more frequently (Tucker et al. 2014:131)

Population Abundance in California

There are no historical studies of fisher population size, abundance, or density in California. Concern over what was perceived to be an alarming decrease in the number of fishers trapped in California led Joseph Dixon, in 1924, to recommend a 3-year closed season to the legislative committee of the State Fish and Game Commission (Grinnell et al. 1937:229). In that year, only 34 fishers were reported taken by trappers in the state (Dixon 1925), with the pelt of one animal reportedly selling for $100 (valued

at $1,366 today, US Bureau of Labor Statistics). Grinnell et al. (1937) concluded that the high value of fisher pelts at that time caused trappers to make special efforts to harvest them. From 1919 to 1946, a total of 462 fishers were reported to have been harvested by trappers in California and the annual harvest averaged 18.5 fishers (Lewis and Zielinski 1996:292–293). Many of the animals were taken in a single trapping season (1920) when 102 fishers were harvested (Dixon 1925:23). Despite concerns about the scarcity of fishers in the state, trapping of fishers was not prohibited until 1946 (Gould 1987).

Grinnell et al. (1937:227) noted that "Fishers are nowhere abundant in California. Even in good fisher country it is unusual to find more than one or two to the township." They roughly estimated the fisher population in California at fewer than 300 animals statewide. Fisher captures in recent years for scientific study suggest that in many areas fishers are currently more common[35] than they were in the 1930s: over a two month period beginning in November 2009, the Department-led translocation project live-trapped 19 fishers from donor sites in northwestern California. A total of 67 fishers were ultimately captured from widely distributed locations in northwestern California from 2009-2012, as part of that project. Within the translocation area in the northern Sierra Nevada, 19 fishers were captured over a period of 28 days that were likely the offspring of animals translocated to the area in 2012 (Powell et al. 2013).

Although using trapping results to describe the relative abundance of species can be misleading due to differences in catch-ability or trap placement, it is noteworthy that capture success for fishers in the translocation release area was higher than for any other species of carnivore trapped (A. Facka, pers. comm.). Other species captured included raccoon (*Procyon lotor*), ringtail (*Bassariscus astutus*), gray fox (*Urocyon cinereoargenteus*), spotted skunk (*Spilogale gracilis*), and opossum (*Didelphis virginiana*). In 2013, fishers were the second most-captured mesocarnivore in the same area (3,172 trap days; spotted skunks were caught at a slightly higher rate), and in 2014 fishers were again the most commonly captured mesocarnivore (2,792 trap days). To capture fishers for the translocation project, project cooperators trapped at a variety of locations in Humboldt, Shasta, Siskiyou, and Trinity counties during 2009-2011 (7,978 trap days). Fishers were the most commonly captured mesocarnivore and represented

[35] Common as in frequently detected by surveys.

39% of all mesocarnivore capture events. The next most frequently captured animals were ringtail (28% of mesocarnivore captures) and gray fox (23% of mesocarnivore captures). (A. Facka, unpublished data).

There are several estimates of fisher population size in northern California. Estimates range from 1,000 to approximately 4,500 fishers statewide. In April 2008, Carlos Carroll indicated that his analysis of fisher data sets from the Hoopa Reservation and the Six Rivers National Forest in northwestern California suggested a regional (northern California and a small portion of adjacent Oregon) fisher population of 1,000-3,000 animals (C. Carroll, pers. comm.). This estimate represented the rounded outermost bounds of the 95% confidence intervals from the analysis. Carroll acknowledged a lack of certainty regarding the population size, as evidenced by the broad range of the estimate. He believed the estimate to be useful for general planning and risk assessment. Self et al. (2008) derived two separate “preliminary” estimates of the size of the fisher population in California. Using estimates of fisher densities from field studies, they used a “deterministic expert method” and an “analytic model based approach” to estimate regional population sizes. The deterministic expert method provided an estimate of 3,079 fishers in northern California, and the model-based regression method estimate was 3,199 fishers.

Estimates of the number of fishers in the southern Sierra Nevada indicate the population is small. Lamberson et al. (2000), using an expert opinion approach, estimated the southern Sierra Nevada fisher population to range from 100-500 animals. Using previous density estimates (Jordan 2007), data from the USFS regional population monitoring program (USDA Forest Service 2006), and a regional habitat suitability model, Spencer et al. (2008) estimated the southern Sierra Nevada population to contain 160-350 fishers, of which 55-120 were estimated to be adult females. Self et al. (2008) estimated the population size of fishers in the southern Sierra Nevada at 598 animals using their deterministic expert method and 548 animals based on their regression model. While cautioning that their estimates were preliminary, the authors emphasized the similarities between the separate estimates. More recent work by Spencer et al. (2011) estimated the southern Sierra Nevada fisher population at 300 individuals.

Population Trend in California

No data are available that document long-term trends in fisher populations in California. However, studies in northern California, estimates of fisher occupancy in the southern Sierra Nevada, and genetic studies provide insight into contemporary and historical trends. Tucker et al. (2012:2,7) concluded that fisher populations in California experienced a 90% decline in effective population size[36] more than 1,000 years ago. They hypothesized that as a result, fishers in California contracted into the two current populations (i.e., northern California and southern Sierra Nevada). If correct, the spatial gap between the fisher populations in northern California and the southern Sierra Nevada long pre-dated Euro-American settlement. No data are available that document long-term trends in fisher populations statewide in California since Euro-American settlement. Population trends over relatively short periods (5-15 years) have been investigated at several study sites in northwestern California, and the southern Sierra Nevada population has been monitored since 2002.

In northern California, Matthews et al. (2011:72) reported substantial declines in the density of fishers on Hoopa Valley Tribal lands from about 52 individuals/100 km^2 (52 individuals/38.6 mi^2) in 1998 to about 14 individuals/100 km^2 (14 individuals/38.6 mi^2) in 2005. Continued monitoring of this population indicates that the overall the population density had increased by 2012-2013, but only to about half of that estimated in 1998. Modeling based on mark-recapture monitoring at Hoopa from 2005-2013 indicated that the population as a whole was “essentially stable while males are likely increasing and females are possibly increasing” (Higley et al. 2013:29).

To assess changes in fisher populations on their lands in coastal northwestern California, Green Diamond Resource Company repeated fisher surveys using track plates in 1994, 1995, 2004, and 2006 (Diller et al. 2008). Detection rates increased slightly from 1994 to 2006. At individual stations, detection rates were higher in 1995,

[36] Effective population size describes the size of an “ideal” population that would have the same rate of genetic change as the population being evaluated (Waples 2002:48) and provides a method for calculating the rate of evolutionary change caused by random sampling of allele frequencies in a finite population (i.e., genetic drift) (Charlesworth 2009:195).

lower in 2004, and higher in 2006. However, there was insufficient statistical power to detect a trend in these detection rates (L. Diller, pers. comm.).

More recent surveys by Green Diamond Resource Company in Del Norte and northern Humboldt counties provide insight into the probability of detecting fishers relative to other carnivores using baited camera stations on its industrial timberlands. Remote camera surveys were conducted at 111 stations from 2011-2013 (Green Diamond Resource Company, unpublished data). Fishers were detected at 71% of the stations. Of the 7 carnivores documented, only bears were more frequently detected (83%) than fishers (Figure 10). Based on surveys conducted from 1994-2011, Hamm et al. (2012) concluded that fishers were "relatively abundant and well distributed throughout the majority of the ownership". It is important to note, however, that fisher detection rates at camera stations may not be a reliable indicator of population trends; at the Hoopa Reservation, fisher camera detection rates increased between 1998 and 2005, despite a concurrent and significant decrease in the fisher population density as estimated by a mark-resight technique (Matthews et al. 2011:72).

Swiers et al. (2013:20) collected hair samples from fishers from 2006-2011 in northern Siskiyou County to examine the potential effects of removing animals from the population for translocation. Their study area included lands managed by two private timber companies and the USFS. Using non-invasive mark-recapture techniques, Swiers (2013) found the population of approximately 50 fishers to be stable, despite the removal of nine fishers that were translocated to Butte County. Estimates of survival and recruitment suggested high population turnover (Swiers 2013:21).

The Department has conducted a large-scale monitoring project for forest carnivores in the Klamath and East Franciscan ecoregions of northwestern California since 2011. Carnivore surveys are conducted using camera traps within forested habitats across a 28,000 km^2 (11,000 mi^2) study area. Occupancy and detection probabilities for fisher were estimated from data collected at 370 survey stations from 2011 to 2014 (Furnas et al. In review). The average occupancy estimate for fisher was 0.414 [90% CI: 0.336-0.469] for camera stations, and 0.632 [90% CI: 0.555-0.718] for pairs of camera stations (i.e., station pairs are 1.6 km (1 mi) apart). The results suggest that fishers are common

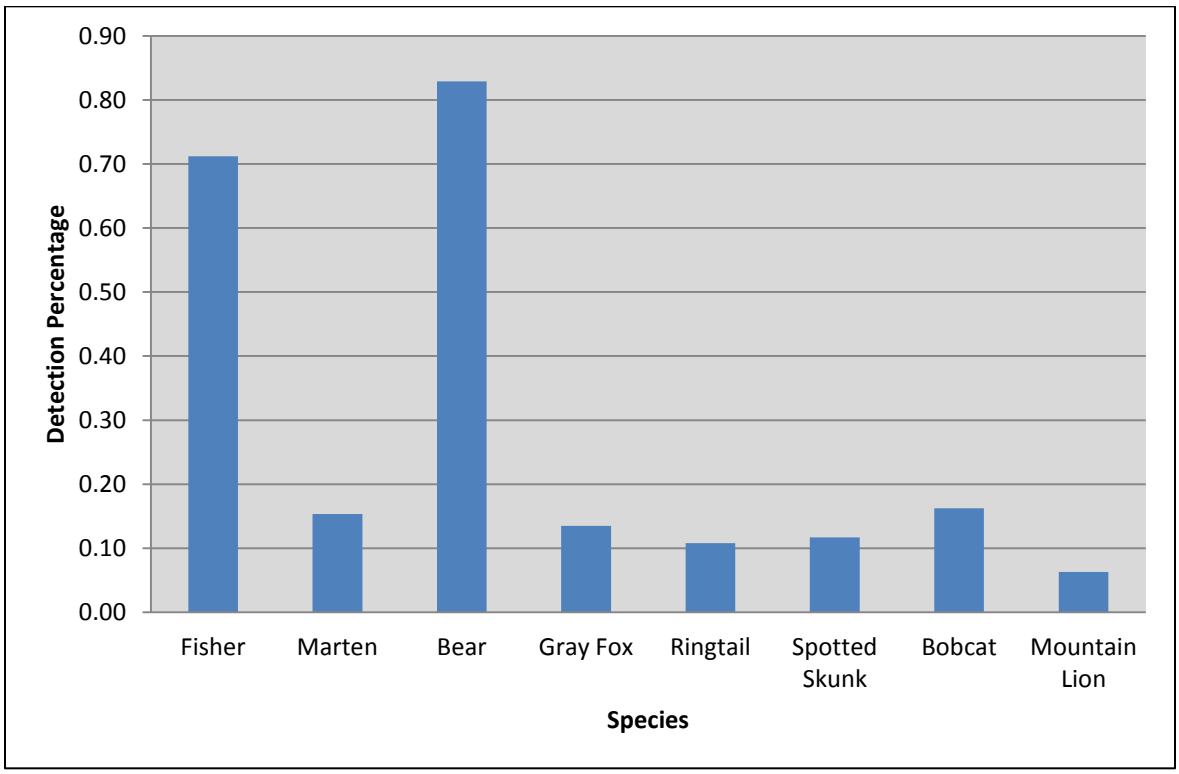

Figure 10. Detections of carnivores at 111 remote camera stations on lands managed by Green Diamond Resource Company in Del Norte and northern Humboldt counties, from 2011-2013. California Department of Fish and Wildlife, 2014.

(i.e., estimated to occur at about 60% of sample units) and widespread (detected throughout much of the sampled ecoregions) throughout the study area (Figure 11).

Despite genetic evidence indicating a long-standing historical separation of fishers in northern California from those in the southern Sierra Nevada (Tucker et al. 2012), anecdotal evidence suggests fishers occurred in the central and northern Sierra Nevada and the southernmost parts of the Cascades post-Euro-American settlement (Price 1894, James 1915, Our annual catch of furbearing animals. 1916, Winter vs. summer furs. 1917, Butler 1920, Durbin 1925, Grinnell et al. 1937). Their abundance in this region at the time of settlement is unknown. Furthermore, it is possible that by the late 1800s, harvest and habitat changes may have reduced the abundance of fishers in this region to low levels. The relatively few specimens reported taken (and no museum specimens) in this area during the early 1900s (see previous sections for a summary of anecdotal reports) suggest that if present, they were relatively scarce at that time.

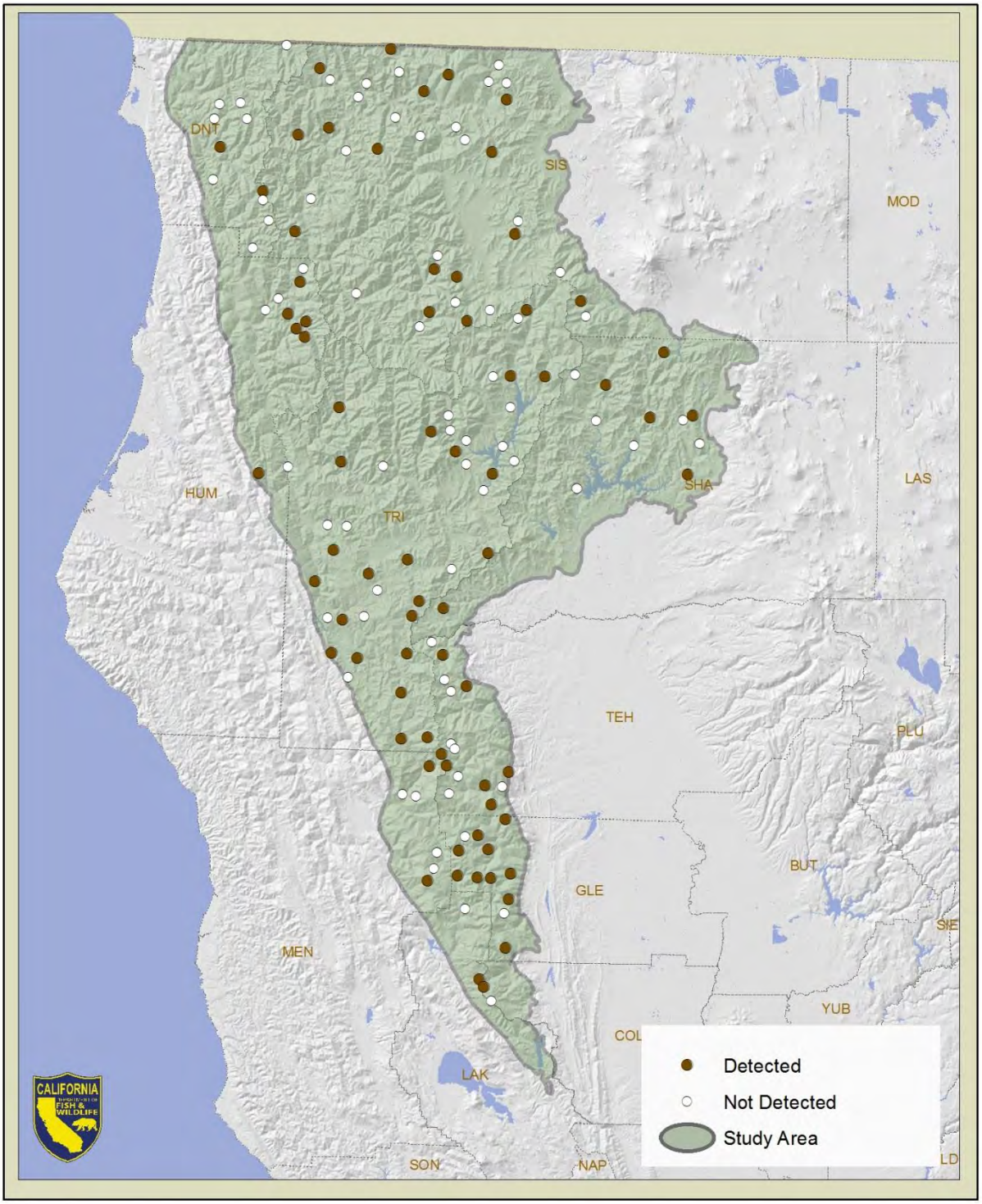

Figure 11. Detections of fishers based on randomly located baited camera trap stations within the Klamath and East Franciscan ecoregions of northwestern California from 2011 through 2013 (Furnas et al. In review). Stations sampled in 2014 are not depicted.

Anthropomorphic changes have been suggested as the likely cause of declining fisher populations in the southern Sierra Nevada during post-settlement (Tucker et al. 2013). Mining and associated human activity in central and northern Sierra was historically extensive (Figure 12). It is likely many miners and other residents of mining camps and towns trapped furbearers to supplement their income. In the early 1900s, Grinnell et al. (1937:11–12) noted that in many rural communities "nearly every boy of school age possesses a few traps which he sets each fall" and also mentioned the efforts of "farm hands, homesteaders, and other persons who use spare time from the usual occupations to tend their lines of traps". Substantial logging also occurred near these settlements to provide building materials, firewood, and fuel for steam engines (McKelvey et al. 1992:225–227).

In the southern Sierra Nevada, Tucker et al. (2012) also detected a bottleneck signal (i.e., reduction in population size) in the northern half of the southern Sierra Nevada population, indicating that portions of that population experienced a second decline post-Euro-American settlement. They hypothesized that the southern tip of the Sierra Nevada may have served as a refugium in the late 19th and 20th centuries and descendants of those fishers may have ultimately recolonized the northern parts of the occupied southern Sierra Nevada range. Tucker et al. (2012:10), using genetic techniques, estimated that the total current population size of fishers in northwestern California could range from 258-2,850 and the southern Sierra Nevada population could range from 334-3,380. This similarity in estimates for the size of these populations is surprising, given that the northern population is believed to be larger in total size than the southern Sierra population (Tucker 2013*b*:20).

Zielinski et al. (2013*a*) implemented a monitoring program for fishers in the southern Sierra Nevada over an 8 year period (2002-2009). They estimated the overall probability of occupancy, adjusted to account for uncertain detection, to be 0.367 (SE = 0.033). Probabilities of occupancy were lowest on the Kern Plateau in the southeastern Sierra Nevada (0.261) and highest on the west slope of the southernmost Sierra Nevada portion of their study area (0.583) (Zielinski et al. 2013*a*:8). They found no statistically significant trend in occupancy during the sampling period and concluded that the small population of fishers in the southern Sierra Nevada did not appear to be declining. This result should be interpreted cautiously, however, as trends in occupancy

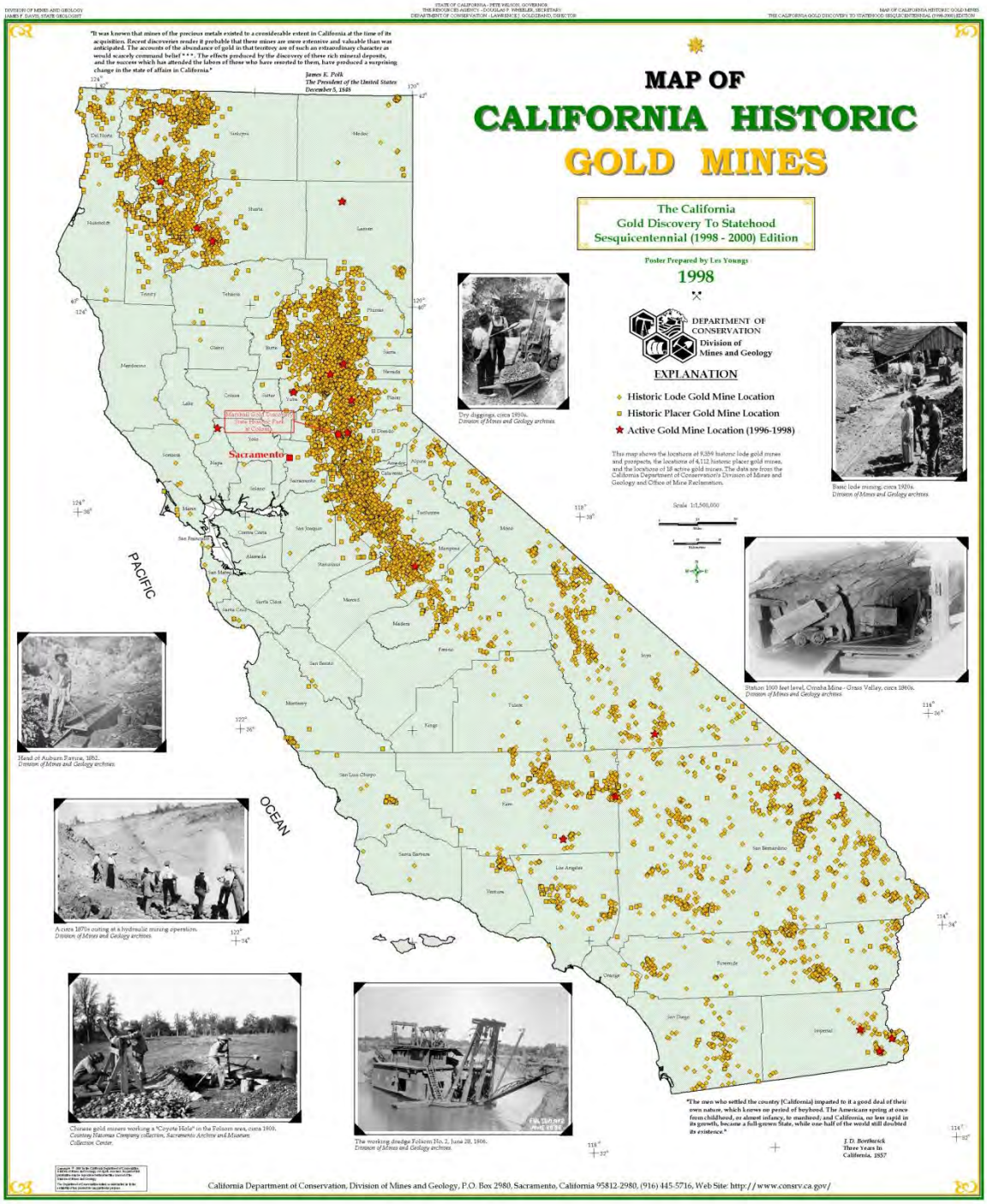

Figure 12. Historical gold mines in California (pre-1996).

may not always be an effective proxy for trends in abundance. Tucker (2013) simulated the ability of a comparable sampling scheme to detect modeled population declines. The results indicated that the relationship between fisher abundance and occupancy were not linear; simulated population declines of 43% and 17% resulted in declines in occupancy estimates of 23% and 6%, respectively. Tucker (2013) concluded that over an eight year period the southern Sierra Nevada fisher monitoring program would likely be able to detect a severe decline, but not a “slower reduction” in size.

Sweitzer et al. (2015) estimated the population size, density, and other demographic parameters of fishers in the northern portion of the southern Sierra Nevada. No trend in fisher population density was detected during 2008-2012. However, based on observed reproductive rates and fisher survival data during the same period, Sweitzer et al. (2015) estimated a slightly negative population growth rate (λ) of 0.97. Although the upper range population growth estimate ($\lambda = 1.16$) suggested stability or growth in some years, the authors noted the overall population trend in conjunction with no increase in density and a small population size warranted concern for their regional viability. Modeling also suggested that a 10% increase in fisher survival would result in a positive population trajectory ($\lambda \approx 1.06$) (Sweitzer et al. 2015).

Factors Affecting the Ability of Fishers to Survive and Reproduce

Population Size and Isolation

Grinnell et al. (1937), considered the range of fishers in California to extend south from the Oregon border to Lake and Marin counties, eastward to Mount Shasta and the Southern Cascades, and to include the southern Cascades south of Mount Shasta through the Sierra Nevada Mountains to Greenhorn Mountain in Kern County. Few records of fishers inhabiting the central and northern Sierra Nevada exist, creating a gap in the species' distribution that has been frequently described in the literature. A number of studies have commented on this gap and considered fishers to have been extirpated from this region during the 20th century (Zielinski et al. 1995, Drew et al. 2003:59). However, recent work by Knaus et al. (2011) and Tucker et al. (2012) indicates fishers in the southern Sierra Nevada became genetically isolated from northern California populations long before Euro-American settlement. Tucker et al. (2012) concluded the fisher's effective population size in California declined approximately 90% over 1,000 years ago and also hypothesized the fisher distribution in California contracted to the two currently occupied areas prior to Euro-American settlement.

Tucker et al. (2012) pointed out that mass extinctions and shifts in the distribution of species occurred at the end of the Pleistocene (Barnosky et al. 2004); isolation at this time would be consistent with the suggestion of divergence dates of fisher populations in California reported by Knaus et al. (2011) that California fisher populations might have diverged approximately 16,700 years ago. However, in California there were two "mega-droughts" during the Medieval Warm Period that lasted over 200 and 140 years each (832-1074 and 1122-1299 AD, respectively). These droughts may have caused fisher populations to contract, isolating (or further isolating) the northwestern population from fishers in the Sierra Nevada (Tucker et al. 2012:10).

In addition to the apparent early contraction of fisher populations in California, a more recent bottleneck may have occurred that was likely associated with the impact of human development in the late 19th century and early 20th century (Tucker et al. 2012:8). Campbell (2004:4,23) suggested that the absence of fishers from the central Sierra Nevada may have been related to habitat changes (anthropogenic or stochastic) that occurred in the region causing a shift from forests characterized by large, old,

widely spaced trees, to dense, mostly even-aged stands of younger, smaller trees. She also hypothesized that differences in human presence and the number of roads in the central Sierra Nevada may explain the absence of fishers from that region. Tucker et al. (2012) suggested that the southern tip of the Sierra Nevada may have served as a refuge during the gold rush and into the first half of the 20th century while the fisher population in the rest of the southern Sierra Nevada was in decline. Fishers in the southern Sierra Nevada may have expanded somewhat since that time and the population appears to have been stable from 2002 to 2009 (Zielinski et al. 2013*a*:10).

Intensive trapping of fishers for fur from the mid-1800s through the mid-1900s likely reduced the statewide fisher population and may have extirpated local populations. In the Sierra Nevada, trapping pressure combined with unfavorable habitat changes during this period may have caused the fisher population to contract to refugia in the southern Sierra Nevada. The results of recent surveys suggest that fishers in the southern Sierra Nevada have expanded their range northward (Tucker et al. 2014:131). In the 1990s, fishers were routinely detected by surveys in the central and southern portions of the SSN ESU, but were rarely detected in the northern portion of the ESU. More recent surveys (Tucker et al. 2014:131) detected fishers considerably more frequently in the northern portions of the ESU, perhaps indicating that fishers have expanded their range in this region. Although fishers appear to have expanded their range within the SSN ESU in recent time, the population remains effectively isolated from fishers elsewhere in California. Should fishers in the southern Sierra Nevada expand their range north of the Merced River, or fishers currently occupying the northern Sierra expand to the south, contact would most likely first occur with the progeny of animals translocated to the northern Sierra Nevada near Stirling in Butte County. However, contact in the near-term (50 years) though natural dispersal is unlikely. Some researchers have expressed concern that restoring connectivity between the California fisher ESUs may result in the loss of local adaptations that have evolved in each population (Tucker et al. 2012, Tucker 2013*a*:11).

Although fishers in northern California are effectively isolated from fishers in the southern Sierra Nevada, they form the core of a regional population that occurs in eight California counties in six USDA ecoregions (eleven counties and seven ecoregions if the translocated animals near Stirling City are considered) and also extends into southwestern Oregon (Curry, Josephine, and Jackson counties). A fisher that was

marked by researchers in Oregon was subsequently live-trapped and released in upper Horse Creek in northern Siskiyou County (R. Swiers, pers. comm.). There is no evidence that the progeny of non-native fishers introduced to the vicinity of Crater Lake, Oregon from British Columbia in 1961 and from Minnesota in 1981, have dispersed to California (Drew et al. 2003, Aubry et al. 2004, Wisely et al. 2004*b*, Farber et al. 2010).

Powell and Zielinski (2005) used the population matrix modeling software VORTEX to evaluate the potential population-level effects of removing fishers from northwestern California for translocation In the process, they also estimated the probability that fishers would become extinct in northwestern California as well as the southern Sierra Nevada during a 100 -year modeling period. Assuming an initial population size of 1,000 fishers in northwestern California and a carrying capacity of 2,000 (±250) animals, Powell and Zielinski (2005) calculated a 5 percent probability of population extinction over a 100 year modeling period. They also calculated the probability of extinction for the southern Sierra Nevada fisher population, using an estimated carrying capacity of 400 fishers, to be 15%. Powell and Zielinski (2005) cautioned that they used estimated probabilities of extinction as an index of population viability, not as dependable estimates of that probability and advocated additional study of fishers in northwestern California to validate their modeling assumptions.

The fisher population in the SSN ESU is likely at greater risk of extirpation than fishers in northern California, due to its small population size, limited geographic range, narrow and linear configuration of available habitat, and isolation. The fisher population in the southern Sierra Nevada may be comprised of fewer than 300 adults (Spencer et al. 2015:7) which, coupled with its isolation, increases its vulnerability to stochastic (random) environmental or demographic events, including catastrophic fire or disease. Small populations are also at greater risk from the loss of genetic diversity, including inbreeding depression (Shaffer 1981).

Present or Threatened Modification or Destruction of Habitat

Life history characteristics of fishers, such as large home range, low fecundity (reproductive rate), and limited dispersal across large areas of open habitat are thought to make fishers vulnerable to landscape-level habitat alteration, such as extensive logging or loss from large stand-replacing wildfires (Powell and Zielinski 1994, Lewis and Stinson 1998). Buskirk and Powell (1994) found that at the landscape scale, the

abundance and distribution of fishers depended on size and suitability of patches of preferred habitat, and the location of open areas in relation to those patches.

Fishers have consistently been associated with expanses of low- to mid-elevation mixed conifer forests characterized by relatively dense canopies. Although fishers occupy a variety of forest types and seral stages, the importance of large trees for denning and resting has been recognized by the majority of published work on this topic (Buskirk and Powell 1994:296, Jones and Garton 1994:384, 386, Zielinski et al. 2004*b*:485, Weir and Corbould 2008:127, Davis 2009:88, 92, Purcell et al. 2009, Lofroth et al. 2010:102) and the home ranges of fishers often include high proportions of mid- to late-seral forests (Raley et al. 2012).

Timber Harvest: Most forest landscapes occupied by fishers have been substantially altered by human settlement and land management activities, including timber harvest. These activities have significantly modified the age composition and structural features of many forests in California. Timber harvest is the principal large-scale management activity taking place on public and private forest lands that has the potential to degrade habitats used by fishers. Habitat degradation resulting from timber harvest could occur through extensive fragmentation of forested landscapes where patches of remaining suitable habitat are small and disconnected or through a reduction in key habitat elements.

Generally, timber harvest has substantially simplified the species composition and structure of forests (Franklin et al. 2002:417–418, Thompson et al. 2003:448–449). Habitat elements used by fishers such as microstructures for denning can take decades to develop. It is possible that the density of those elements has been substantially reduced and fisher fitness in those areas may have consequently declined. Timber harvesting often creates non-forested areas (e.g., newly harvested clearcuts) that often have little canopy cover for at least a decade after harvest and subsequent reforestation (James et al. 2012:62). Fishers are known to select against non-forested areas (Jones and Garton 1994:382) and in British Columbia a 5% increase in open areas within a potential fisher home range over 12 years was estimated to decrease its probability of occupancy by 50% (Weir and Corbould 2010:407). Those findings notwithstanding, fishers are regularly detected on industrial timberland ownerships in northern California where clearcuts are commonplace (Reno et al. 2008, Farber et al. 2010, Hamm et al.

2012, Powell et al. 2013, Swiers 2013) and industrial timberland forms the core area for a newly established fisher population in Butte County (Powell et al. 2013). The fitness of fisher populations in these areas is largely unknown, although ongoing study of the translocated population in Butte County (e.g., Powell et al. (2013)) should provide substantial insight regarding fisher habitat use and quality in an intensively managed area.

Most of the old growth and late seral forest in California outside of National Parks and Wilderness Areas has been subject to timber harvesting in some form since the 19th century. The demand for and uses of forest products have increased over time and some trees historically considered unmerchantable and left on forest lands when the majority of old-growth timber was logged are merchantable in today's markets. Silvicultural methods, harvest frequency, and post-harvest treatments have influenced the suitability of habitats for fisher. Of the historical range of the fisher in California estimated by Grinnell et al. (1937), nearly 61% is in public ownership and about 37% is privately owned (Figure 13). Within the current estimated range of fishers in the state, greater than 50% of the land within each ESU is in public ownership and is primarily administered by the USFS or the National Park Service (Figure 14). Private lands within the NC ESU and the SSN ESU represent about 41% and 10% of the total area within each ESU, respectively.

The volume of timber harvested on public and private lands in California has generally declined since late 1980s (Figure 15). On USFS lands the number of acres harvested annually in California within the range of the fisher also declined substantially in recent decades (USDA 2014). Sawtimber volume[37] harvested from the National Forests in both the NC and SSN ESUs declined substantially in the early 1990s and has remained at relatively low levels (Figures 16 and 17). Still, timber harvesting historically removed some older forest elements (e.g., large trees for resting of denning) used by

[37] Sawtimber volume equaled the net volume in board feet of sawlogs harvested from commercial tree species containing at least one at least one 3.7 m (12 ft) sawlog or two noncontiguous 2.4 m (8 ft) sawlogs.

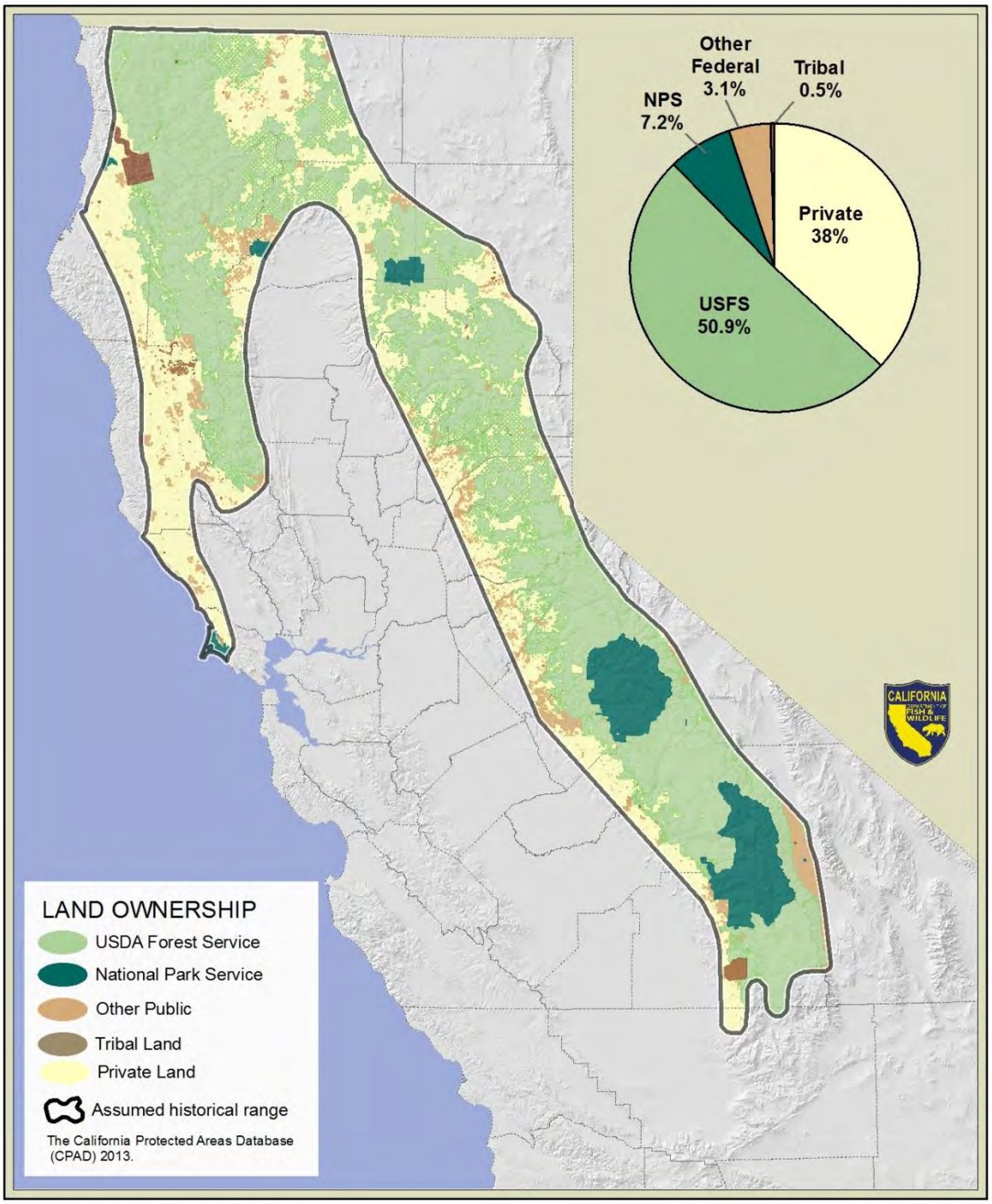

Figure 13. Landownership within the historical range of fishers depicted by Grinnell et al. (1937). California Department of Fish and Wildlife, 2014.

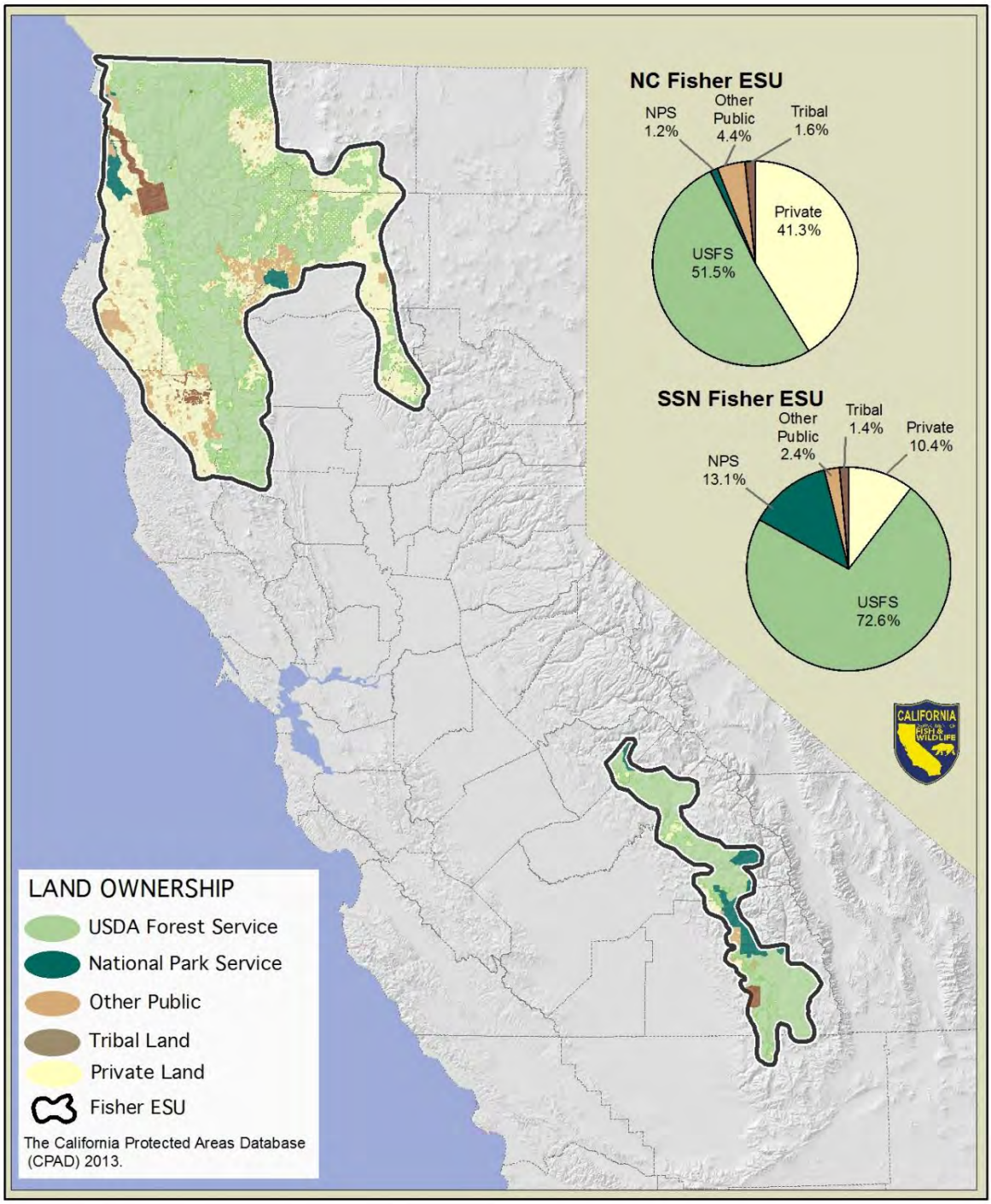

Figure 14. Landownership within the Northern California Fisher Evolutionarily Significant Unit (NC ESU) and the Southern Sierra Nevada Evolutionarily Significant Unit (SSN ESU) (CDFW, unpublished data, USFWS, unpublished data), 2014.

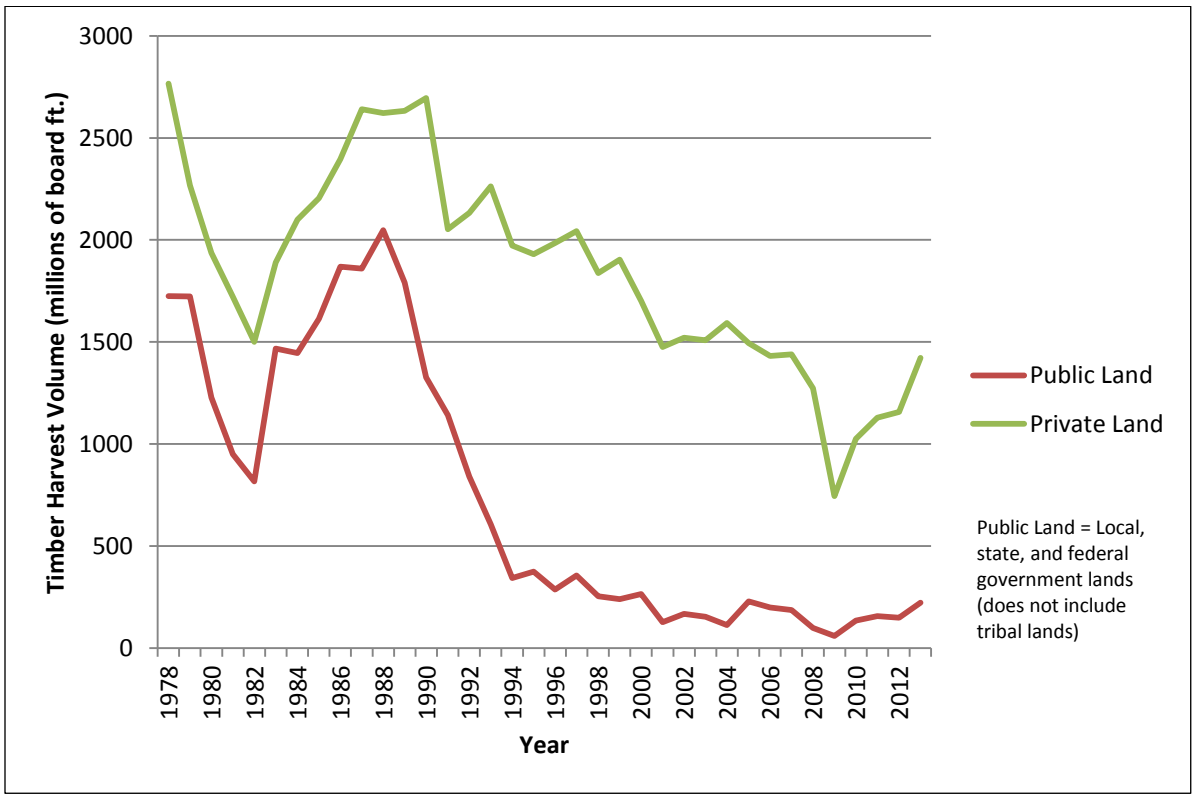

Figure 15. Volume of timber harvested on public and private lands in California (1978-2013) (California Timber Harvest Statistics n.d.).

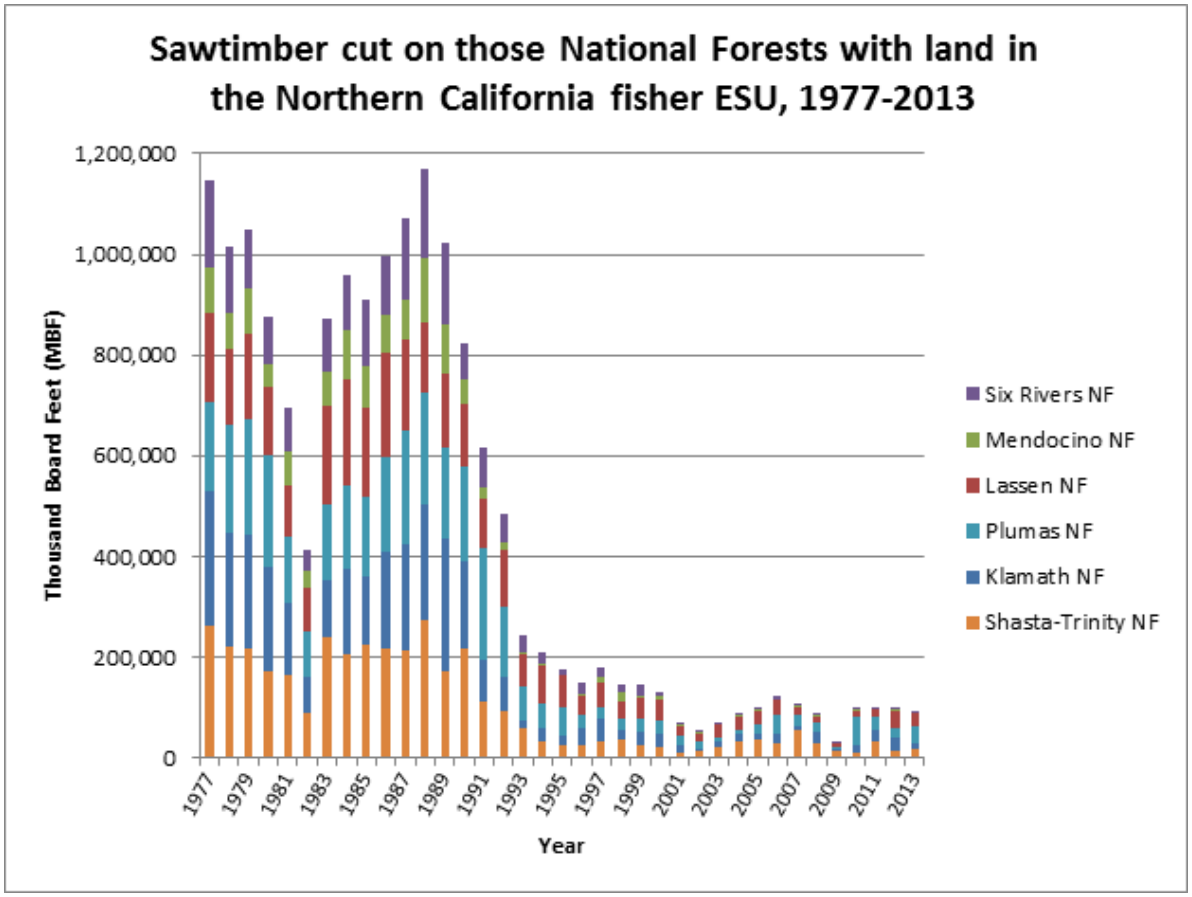

Figure 16. Sawtimber cut on National Forests within the Northern California Fisher ESU from 1977-2013 (USDA 2014).

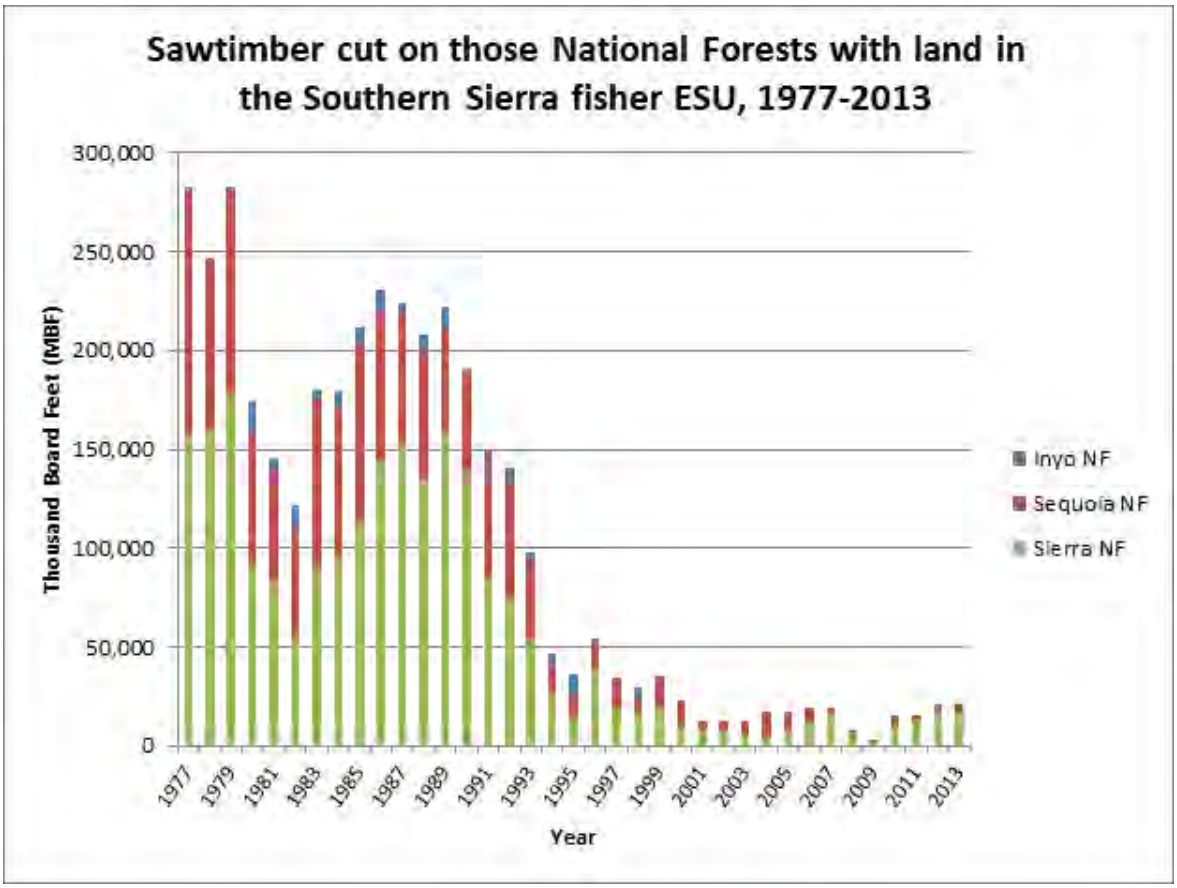

Figure 17. Sawtimber cut on National Forests within the Southern Sierra Fisher ESU from 1977-2013 (USDA 2014).

fishers and insufficient time has transpired for those trees to be replaced through harvest rotations.

Fishers are known to establish home ranges and successfully reproduce within forested landscapes that have been and are being intensively managed primarily for timber production, including industrial ownerships where ongoing intensive even-aged management is the norm. The long-term viability of fishers across their range in California will depend on the continued presence of suitable denning and resting sites and habitats capable of supporting foraging activities. While such structures and habitats are critical to fisher reproduction and survival, the Department is not aware of evidence indicating that habitat modification resulting from timber harvesting and forest management is currently limiting fisher populations in California.

Fuels Treatment: Decades of fire suppression has led to substantial accumulations of woody fuels in forests and increased the risk of large-scale catastrophic fires within the range of fishers in California. In some cases, the absence of fire has resulted in the development of dense and structurally complex forests used by fishers. Vegetation management projects designed to reduce wildfire fuel loads can degrade fisher habitat by removing forest structures important to fishers, decreasing canopy cover, reducing understory vegetation, and vegetation diversity (Naney et al. 2012:12).

Fuels reduction treatments designed to reduce the risk of catastrophic fires have become a priority for federal land management agencies (Truex and Zielinski 2013). Land managers tasked with reducing the risk of fire in forests and with conserving wildlife are challenged by implementing effective fuels treatments while meeting conservation goals for fisher populations (Garner 2013).

Although the effects of fuels treatments on fishers is largely unknown in northern California, a number of studies have examined the effects of fuel treatments on fishers within the SSN ESU (Powell and Zielinski 2005; Thompson et al. 2011; Garner 2013; Truex and Zielinski 2013; Zielinski et al. 2013b). Garner (2013) reported that the home ranges of fishers radio-collared for the Kings River Fisher Project tended to include a greater proportion of sites treated for fuel than the landscape overall, but fishers tended to avoid sites within 200 m (656 ft) of treated areas in favor of untreated forest. Truex and Zielinski (2013) evaluated the effect of fuels treatments on fishers by predicting resting and foraging habitat value at two sites in the Sierra Nevada. They reported that the type of treatment and timing of treatment affected the predicted value of resting habitat for fishers. Reductions in canopy cover adversely affected the value of resting habitat, but foraging habitat was unaffected by fuels treatments at either study site.

Thompson et al. (2011) simulated the effects of fuels treatments and fire on the home ranges of female fishers within two management units in the Sierra National Forest (compared to the existing distribution of vegetation attributes found within the home ranges of female fishers in the area). Conditions in the untreated or “no action” simulation remained relatively unchanged for about 30 years before habitat heterogeneity declined due to forest succession and habitat conditions began to deviate from those found within currently occupied home ranges. The authors did not speculate as to whether those changes would represent a reduction or an increase in habitat

quality. In comparison, a simulated fuel treatment (thinning from below with an 89 cm (35 in) maximum dbh harvest) reduced the distribution of some forest elements below those found within current female home ranges, but resulted in little overall change in habitat suitability. Adding a large simulated wildfire to each scenario resulted in divergence from the reference conditions, with far greater effects in the "no action" (unthinned) simulation.

Zielinski et al. (2013*b*) investigated the tolerance of fishers to the amount of management-related disturbance predicted by fire ecologists that would be needed to reduce the rate at which fires spread and the severity of fires in the southern Sierra Nevada. Disturbance types included thinning, prescribed fire, or timber harvest (e.g., clear cutting, selection harvest). Their findings suggested that areas where disturbance was relatively low (2.6% annually) were consistently occupied by fisher at the highest rate of use. This relatively low level of disturbance was more than predicted by fire experts as needed to reduce fire spread and severity in the southern Sierra Nevada, but less that predicted to be necessary by fire models in other geographic areas (Zielinski et al. 2013*b*). The authors suggested that it may be possible to treat fuels at an extent and rate that achieves fire modeling goals and does not affect occupancy by fishers. Zielinski et al. (2013*b*) cautioned, however, that restorative treatments to reduce fire spread and severity should consider the protection of large conifers and large hardwoods used for denning and resting as well as maintenance of habitat connectivity.

In fire-prone forest types in the southern Sierra Nevada, the risks of carefully considered forest management to sensitive species including fishers is lower than the risks of inaction and continued suppression of fires (North et al. 2009:26). This assessment was supported by Scheller et al. (2011:1499) who modeled the effects of wildfires and fuels management on fisher habitat and population size. They concluded that the positive effects of treatment of fisher habitat exceeded short-term negative effects and indicated that these potential benefits may be particularly important if wildfires become larger and more severe. Generally, it appears that the treatment of fuels within forests in the southern Sierra Nevada to reduce the risk of catastrophic fire and maintain habitat suitable for fishers, provide important habitat elements (e.g., large conifers and hardwoods used for resting and denning) could be accomplished while maintaining habitat connectivity (Garner 2013, Zielinski et al. 2013*b*). Nevertheless, Scheller et al. (2011:1501) advocated a precautionary approach to implementing fuels treatments in

areas where they would be maximally effective at reducing fire and/or minimally reducing fisher habitat quality. They also emphasized the large uncertainty in their projections due to stochastic spatial and temporal dynamics of wildfires and fisher populations.

Fire: Federal fire policy formally began with the establishment of forest reserves in the 1800s and early 1900s (Stephens and Sugihara 2006:433). In 1905, the U.S. Forest Service was established as a separate agency to manage the reserves (ultimately National forests). Concern that these reserves would be destroyed by fire led to the development of a national policy of fire suppression (Stephens and Sugihara 2006:433). In the 1920s, the USFS' view of fire suppression was strongly influenced by Show and Kotok (1923) who concluded that fire, particularly repeated burnings, discouraged regeneration of mixed conifer forests and created unnatural forests that favored mature pines. In 1924, Congress passed the Clarke-McNary Act that established fire exclusion as a national policy and formed the basis for USFS and National Park Service policies of absolute suppression of fires until those policies were reconsidered in the 1960s (Stephens et al. 2007:212).

Fire suppression efforts proved very successful. In California from 1950-1999, wildfires burned on average 1,020 km^2/year (394 mi^2/year) representing only 5.6% of the area estimated to have burned in a similar period of time prior to 1800 (Stephens et al. 2007:212). Prior to Euro-American settlement, fires deliberately set by Native Americans were designed to manage vegetation for food and improve hunting (Taylor and Skinner 1998:288) and to reduce catastrophic fires (Anderson 2006:417). Fires set by indigenous people and fires started by lightning have been estimated to have burned from 23,000 km^2 to more than 53,000 km^2 (8,880 mi^2 to more than 20,463 mi^2) annually in California (Martin and Sapsis 1992:150, 152). Historically, the return interval for most fires in California within fisher range was 0-35 years and these fires were of low and mixed severity (USDA 2015) (Figures 18 and 19).

Effective fire suppression efforts have dramatically altered the structure of some forests in California by enabling increases in tree density, increases in forest canopy cover, changes in tree species composition, and forest encroachment into meadows. These efforts have also contributed to the potential for fires to be larger in extent and more severe. Forest wildfires in the western United States have become larger and more

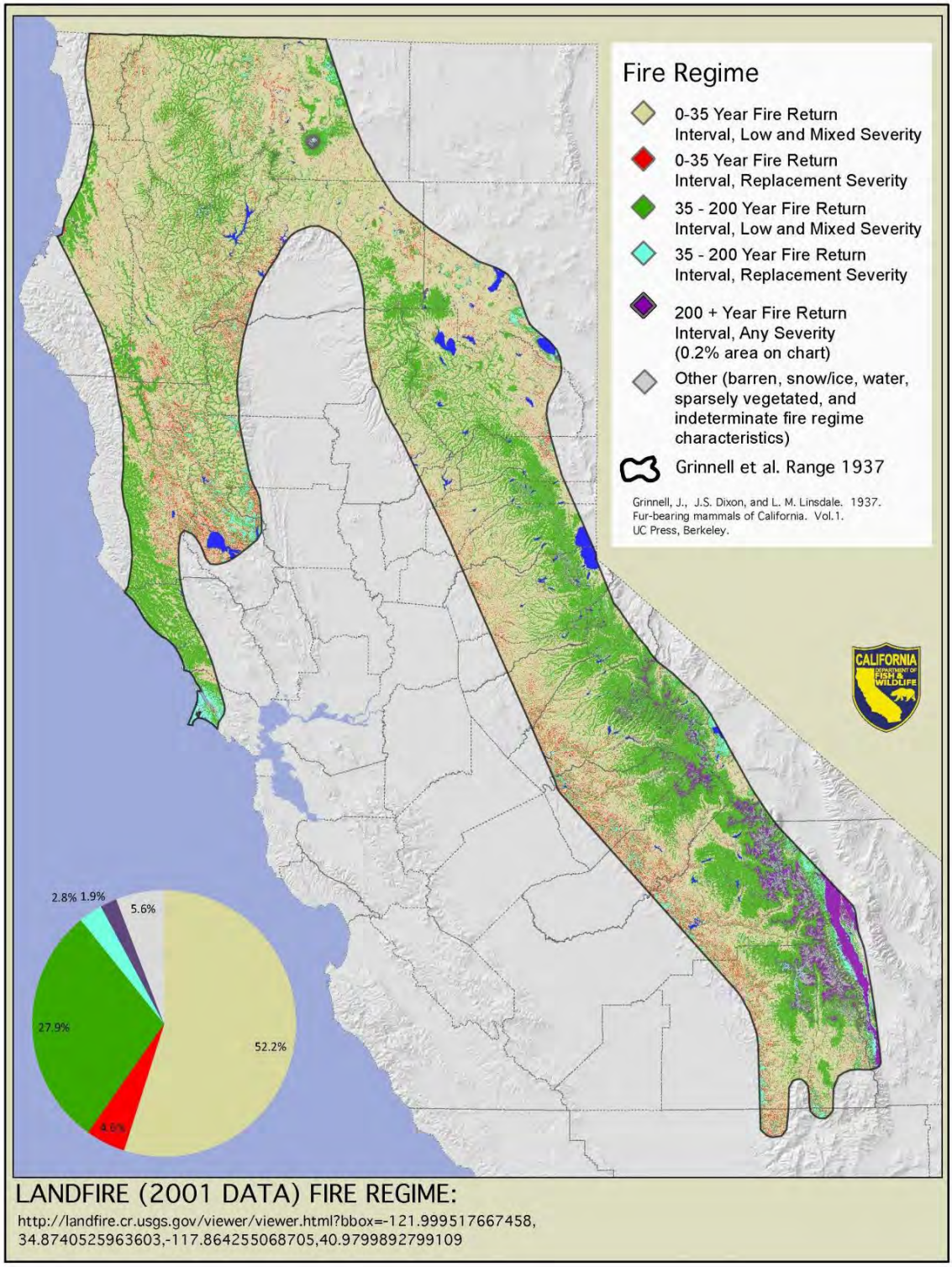

Figure 18. Presumed historical fire regimes within the historical range of fishers in California described by Grinnell et al. (1937). Depictions of fire return intervals and severity were produced using Landscape Fire and Resource Management Tools (USDA 2015). California Department of Fish and Wildlife, 2014.

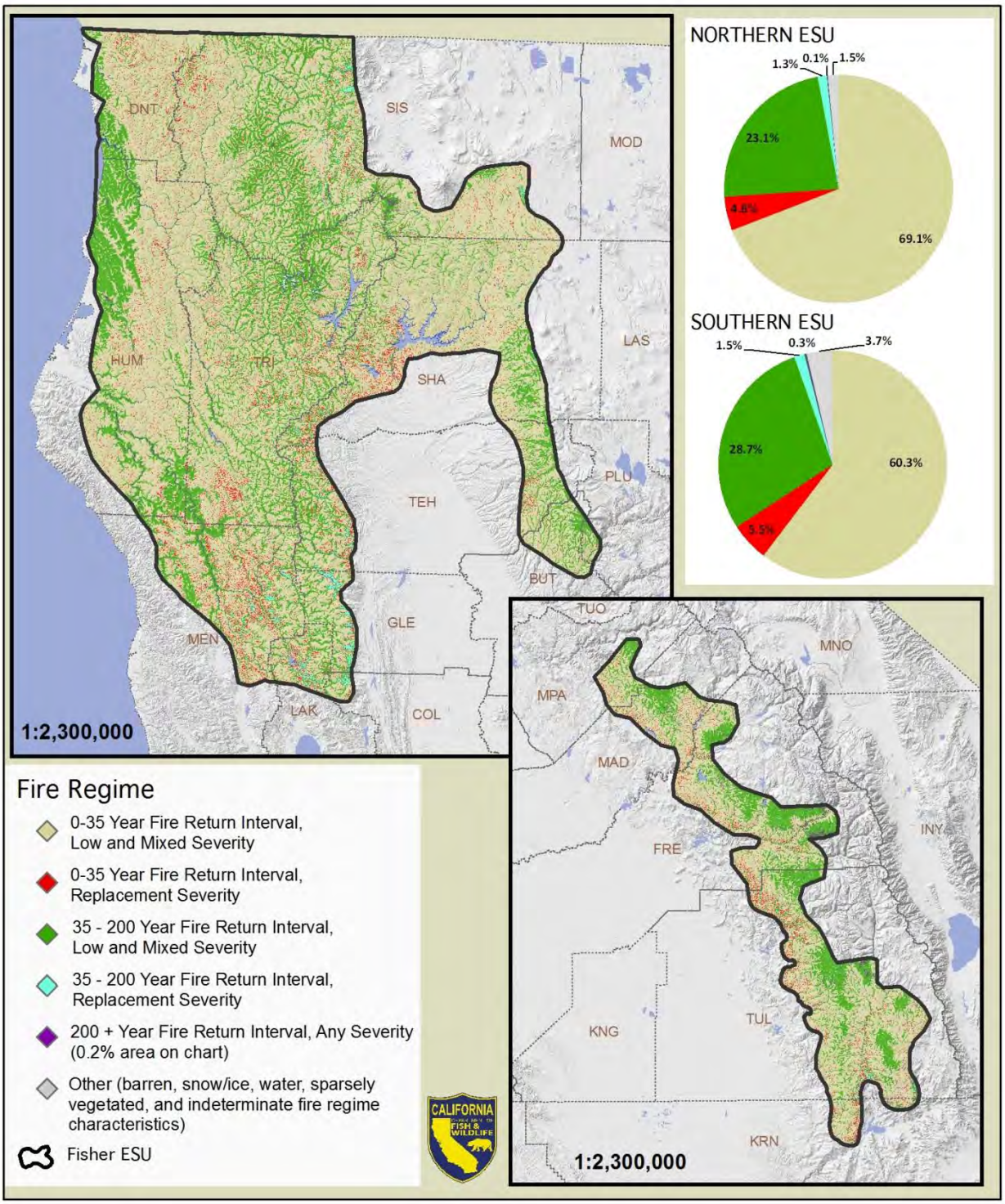

Figure 19. Presumed historical fire regimes within the Northern California Fisher Evolutionarily Significant Unit and the Southern California Fisher Evolutionarily Significant Unit. Depictions of fire return intervals and severity were produced using Landscape Fire and Resource Management Tools (USDA 2015). California Department of Fish and Wildlife, 2014.

frequent (Miller et al. 2009:16). Westerling et al. (2006:941) found a nearly four-fold increase in the frequency of large (>400 ha [988 ac]) wildfires in western forests in the period of 1987-2003 compared to 1970-1986, and found that the total area burned increased more than six and a half times its previous level. This includes regions occupied by fishers in California.

The large mixed severity fires in recent years have contributed to concerns that fire exclusion has created an unprecedented threat of uncharacteristically severe fire (Odion et al. 2014:1). To evaluate historical fire regimes in portions of western North America Odion et al. (2014)), compiled evidence of fire severity patterns in ponderosa pine and mixed-conifer forests. This included the Klamath Mountains, southern Cascades, and Sierra Nevada of California. Odion et al. (2014:12) suggested that mixed-severity fire regimes (e.g., fires that included low-, moderate-, and high severity effects) historically were the predominant fire regime for most ponderosa pine and mixed-conifer forests of western North America. They reported that prior to Euro-American settlement and fire exclusion, these forests exhibited much greater structural and successional diversity influenced by ecologically significant amounts of weather-driven, high-severity fire than has typically been assumed.

Baker (2014) tested a number of hypotheses about historical forest structure and fires using General Land Office survey data across 3,300 km^2 (1,274 mi^2) of Sierra mixed-conifer forests in the western Sierra Nevada. Baker (2014) concluded that a number of lines of evidence (early scientific reports, aerial photography, tree-ring reconstructions, analysis of General Land Office surveys in the late 1800s, and age-structure analysis) indicated that high-severity fire and dense forests were a substantial component of historical forests in the Sierra Nevada. Low-severity fire represented only 13% of the northern and 26% of the southern Sierra Nevada (Baker 2014:18). Open forest conditions in the Sierra Nevada represented only 23% of the northern and 33% of the southern Sierra Nevada (Baker 2014:22). Dense forests historically comprised 65% of the northern and 46% of the southern Sierra Nevada and the landscape was not dominated by large trees (i.e., trees exceeding 60 cm (24 in) in diameter. Trees of that size only comprised about 21% and 33% of the northern and southern Sierra Nevada, respectively (Baker 2014:24). Thus, forests in the Sierra Nevada were not largely park-like, but instead were mostly densely vegetated, prone to fires of high- and mixed-severity which, coupled with topography, contributed to a heterogeneous forest

structure (Baker 2014:26). Steel et al. (2015) characterized Baker's work as "controversial" and questioned Baker's techniques and findings. The authors also came to different conclusions about historical fire severity in many California forests. Steel et al. (2015) found that the area currently burned at high severity in mixed conifer and mixed evergreen forests (26% and 17%, respectively) is much higher than prior to Euro-American settlement (2-8%). Their work supported the notion that lack of fire in these forest types leads to higher rates of high-severity burning.

Wildfires affect habitats used by fishers and can directly affect individual animals. At the landscape level, the impact of fires on fishers is likely related to fire frequency, fire severity, the size individual fires, and the geographic location of fires. Increased fire frequency, size, and severity within occupied fisher range in California could result in mortality of fishers during fire events, diminish habitat carrying capacity, create habitat conditions that favor predators of fishers, inhibit dispersal, and isolate local populations of fishers. There is little scientific information about the use of burned areas by fishers, but evidence from studies of habitat use and demographics suggests that fishers cannot meet all life requisites within large areas burned by high severity fires (Spencer et al. 2015:59). Wildfire may benefit fishers if it enhances prey populations or have negative effects if it results in a categorical loss of fisher habitat (Hanson 2013:24). In northern California, fisher occupancy and abundance based on random camera trap surveys were associated with the percentage of the 10-km (6.2 mi) radius area surrounding each survey station that had burned over the preceding 50 years (Furnas et al. In review). Both metrics were maximized when approximately 40% of the surrounding area had burned, which was greater than the average frequency (25%) of fire across the study area for these spatial and temporal scales.

High intensity fires that involve large areas of forest (stand replacing fires) can have long-term adverse effects on local populations of fishers by the elimination of expanses of forest cover used by fishers, the loss of habitat elements such as dens and rest sites that take decades to form, reductions in prey, and creation of potential barriers to dispersal. Safford et al. (2006:11), believed that overall the most significant outcome of potential losses in canopy cover and/or surface wood debris resulting from increased frequencies of mixed and high severity fires would be changes or reductions in densities of fisher prey. Nevertheless, fire is an important component of landscapes that shapes forest structure, vegetation communities, and the availability of habitat elements

important to many species of wildlife. Fire scarring of trees can produce conditions that allow decay organisms to facilitate the formation of cavities (Carey 1983:178) and may provide suitable den sites for fishers (Lofroth et al. 2010:115). In the coastal redwood region on lands managed by Green Diamond Resources, the majority of tree cavities used by fishers as dens result from fire scars. The lack of fire in this region will likely result in the loss of late seral habitat elements important to fishers (L. Diller, pers. comm.)

In the Sierra Nevada, wildfire severity and the extent of area burned annually increased substantially since the beginning of the 1980s, equaling or exceeding levels from decades prior to the 1940s when fire suppression became national policy (Miller et al. 2009:16). Miller et al. (2012:185) also examined trends and patterns in the size and frequency of fires from 1910 to 2008, and the percentage of high-severity fires from 1987 to 2008 on four national forests in northwestern California. From 1910 to 2008, the mean and maximum size of fires greater than 40 ha (99 ac) and total annual area burned increased. However, they found no significant trend in fire severity during the analysis period.

Within the NC ESU, the Fountain Fire in eastern Shasta County burned approximately 25,900 ha (64,000 ac) in 1992, near the southern extent of the fisher range in the southern Cascades. This was a severe fire and likely created a temporary barrier to fisher movements across the largely barren landscape that remained for several years post-burn. Most of the land within the fire's perimeter was privately owned and commercial timberland owners salvaged burned trees and replanted seedlings rapidly after the burn (Zhang et al. 2008). In recent years, fishers have been detected south of the Fountain Fire in areas where previous surveys failed to detect their presence (CDFW unpublished data, Sierra Pacific Industries unpublished data), indicating that some animals may have dispersed through areas of young forest or chaparral (although it is possible that these animals were already present in these areas prior to the burn). From December 2013 through March 2014, Roseburg Resources conducted surveys for fishers using remotely triggered cameras within the boundary of the Fountain Fire and adjacent to its southern boundary. Fishers were detected at 6 of 13 (46%) sample units that were totally within or mostly within areas burned by the Fountain Fire. Fishers were also detected at 4 of 7 (57%) units surveyed on property adjacent to the southern boundary of the fire (R. Klug, pers. comm.).

In 2013, the Rim Fire burned approximately 1,040 km^2 (402 mi^2) in Tuolumne County and was situated just north of the SSN ESU. This human-caused fire resulted in contiguous areas of stand-replacing fire greater than 12,140 ha (30,000 ac) and represents the largest fire recorded in the Sierra Nevada (USFS unpublished data, cited by Spencer et al. (2015:59)). Approximately 35% of the fire area burned at high severity and another 27% burned at moderate severity. The loss of forest and shrub canopy due to the fire has likely created a barrier to the potential expansion of fishers northward from the southern Sierra Nevada population until the vegetation recovers sufficiently to facilitate its use by fishers. Large areas that burned at high severity during the Rim Fire, resulted in a shift in potential dispersal habitat eastward to higher-elevation forests that did not burn at high severity (Spencer et al. 2015:56). In 2013, the Aspen Fire burned 93 km^2 (36 mi^2) within portions of the southern Sierra Nevada occupied by fishers. This fire burned in a mosaic of mostly low to moderate severity, which some patches that burned at high-severity (Spencer et al. 2015:47).

Despite the occurrence of some large, high intensity fires in the southern Sierra Nevada in recent years (e.g., Rim Fire, Aspen Fire), wildfires in the region are generally heavily suppressed. Hanson (2013:25), investigated fisher habitat using scat detector dogs in the northern Kern Plateau in the southern Sierra Nevada, the majority of which was affected by several large fires of mixed-severity. He did not find evidence of a categorical adverse response of fishers to these large fires which had burned 10-12 years prior to his study. Detection rates for fishers were similar between dense, mature/old mixed conifer forest that had burned with moderate/high severity and unburned dense, mature/old mixed conifer forest. Hanson (2013:27–28) suggested that moderate/higher-severity fire in mature/old forests with moderate to high pre-fire canopy cover was beneficial to fishers due to their high structural complexity and density of prey. Spencer et al. (2015:59) however, was critical of Hanson's work and believed that no conclusions could be made regarding the effects of moderate or severe fire on fisher habitat use. Spencer and his coauthors believed that Hanson did not sample large areas burned at moderate to high severity sufficiently and, therefore, could not draw conclusions about the use of those areas by fishers.

Lawler et al. (2012) predicted that fires will be more frequent but less intense by the end of the 21st century due to changes in climate in both the Klamath and the Sierra Nevada mountains. However, others have predicted an increase in large, more intense fires in

the Sierra Nevada, but negligible change in fire patterns in the coastal redwoods (Fried et al. 2004). Westerling et al. (2011:S447), modeled large [> 200 ha and > 8,500 ha (> 494 ac and > 21,004 ac)] wildfire occurrence as a product of projected climate, human population, and development scenarios. The majority of scenarios modeled indicated significant increases in large wildfires are likely by the middle of this century. The area burned by wildfires was predicted to increase dramatically throughout mountain forested areas in northern California and, in the Sierra Nevada, projected increases were greatest in mid-elevation sites on the west side of the range (Westerling et al. 2011:S459). The authors cautioned that their results reflect the use of illustrative models and underlying assumptions; such that predictions for a particular time and location cannot be considered reliable and that the models used were based on fixed effects (i.e., no future changes in management strategies to mitigate or adapt to the effects on climate and development on wildfire). Should these changes in fire regime occur, over the long term they will likely decrease habitat features important to fishers such as large or decadent trees, snags, woody debris, and canopy cover (Mckenzie et al. 2004:898, Safford 2006:11, Krawchuk and Moritz 2012).

Drought and Insects: An emerging issue in California forests is the mortality of conifers from the effects of prolonged drought and the interaction of drought-stressed trees with insect pests. California's forests are subject to damage from a variety of native insects (bark beetles, wood borers, and defoliators), and increasingly from non-native forest pests (CDF 2010). California forests have experienced bark beetle and woodborer outbreaks nearly every decade since 1949, with the most recent significant outbreak in the mountains of southern California in the early 2000s (CDF 2010). Drought-related insect outbreaks have the potential to alter the structure of large areas of conifer forests. The California Department of Forestry and Fire Protection recently determined that 1.7 million acres of Sierra Mixed Conifer forest was in need of restoration following forest pest infestations, and that the majority of pest-damaged forest was found in the Sierra Nevada, Modoc, and Klamath-North Coast regions (Ibid.).

It is not possible to precisely predict how changes in California's climate will affect forest pests, but a warmer, drier climate would be expected to result in increased overwinter survival of insect pests and a decreased capacity of host trees to repel invading insects (Lawler et al. 2012, Trotter 2013). More complicated relationships between forests, insects, and climate were identified by Trotter (2013), including changes in forest pest

organism's geographic distributions, changes in the reproductive capacity of forest pests (e.g. increases in the number of generations produced per year), changes in the synchrony between hosts, pests, and predators, and changes in fire regimes. The interaction between climate, forests, insects, and fire appears to already be driving rapid ecosystem changes in western forests, and appears to have resulted in significant changes in pine (*Pinus* spp.) distribution in the southwestern United States (Lawler et al. 2012). On small scales the mortality of conifers could be expected to improve fisher habitat by providing resting, foraging, and denning structures; however conifer mortality on a large scale would degrade fisher habitat and increase the likelihood of habitat loss from large, severe fires (Ibid.).

Recent (spring of 2015) surveys of the southern Sierra Nevada have detected a dramatic increase in tree mortality from insect outbreaks, primarily in pine trees at lower elevations (USDA 2015). Mortality in southern Sierra pines is largely attributed to western pine beetle (*Dendroctonus ponderosae*) attacks which are estimated to have killed more than five million trees on the Sierra and Sequoia national forests alone (Ibid.). As the southern Sierra received below average precipitation over the winter of 2014/2015 it appears likely that insect outbreaks will expand over the coming summer, and may reach a level that substantially impacts fisher habitat in the southern Sierra.

Human Population Growth and Development: The human population in California has increased substantially in recent decades. Based on population estimates by the California Department of Finance, from 1970 to 2010 (CDOF 1991, 2011) the state's population increased by approximately 46% and population growth is expected to continue. Estimates indicate nearly 38 million people currently reside in the state (CDOF 2013*a*) and those numbers are expected to reach approximately 53 million by 2060 (CDOF 2013*b*), an increase of about 27%. Human population growth rate in the Sierra Nevada is expected to continue to exceed the state average (Bunn et al. 2007).

The California Department of Forestry and Fire Protection (CAL FIRE) has estimated that statewide, between 2000 and 2040, about 10,500 km^2 (4,054 mi^2) of private forests and rangelands will be impacted by new development (FRAP 2003:7). New development was defined as a housing density of one or more units per 8 ha (20 ac). Hardwood forest, Woodland Shrub, Grassland, and Desert land cover types were predicted to experience the most development, encompassing about 3,600 km^2 (1,390

mi^2). Development projected to occur between 2000 and 2040 in habitats potentially suitable for fishers was comparatively low (6%).

By 2030, within the NC and SSN ESUs, human development (structures) on parcels less than 16.2 ha (40 ac) is projected to occur primarily on private lands and will encompass 4% and 5% of the total area of each ESU, respectively (Figure 20, Table 1). This represents an increase of about 1% in the area developed on parcels of that size within each ESU. Development that may occur within suitable fisher habitat on parcels greater than 16.2 ha (40 ac) was excluded from this assessment because most parcels of that size will likely provide some fisher habitat post-development.

Within the NC ESU, most future development is projected to occur in habitats predicted to be of intermediate or high value to fishers however, it is not expected to exceed approximately 2.2% of the NC ESU (Table 2). Similarly, within the SSN ESU, most future development is projected to occur within intermediate and high value habitats for fishers, but this represents less than 3% of the total ESU area (Table 2).
Fishers in the SSN ESU occur in a relatively narrow band of habitat that extends in a north-south corridor in the Sierra Nevada. Development predicted to occur In the vicinity of Shaver Lake in the southern Sierra Nevada by 2030, could adversely affect fishers if it creates a barrier to their dispersal through this region (Figure 20).

Duane (1996:229–330) identified at least five ways land conversion can directly affect vegetation and wildlife including loss of habitat, fragmentation and isolation of habitat, harassment by domestic dogs and cats, and impacts from the introduction of invasive plants. Additional threats to wildlife include increased risk of exposure to diseases shared with domestic animals, mortality from vehicles, disturbance, impediments to movement, exposure to toxicants, entrapment in structures, and increased fire frequency and severity. Fishers are known to occur near human residences, interact with domestic animals, and consume food or water left outside for pets or to specifically feed wildlife (Figure 21, CDFW unpublished data). It is likely that this exposure increases the risk of fishers contracting diseases, some of which can be fatal to them (e.g., canine distemper). Fishers have occasionally been discovered to have died after becoming entrapped in structures such as uncovered water tanks. Although about half of the development on parcels less than 16.2 ha (40 ac) is predicted to occur within intermediate and high value habitat, the area involved is relatively small.

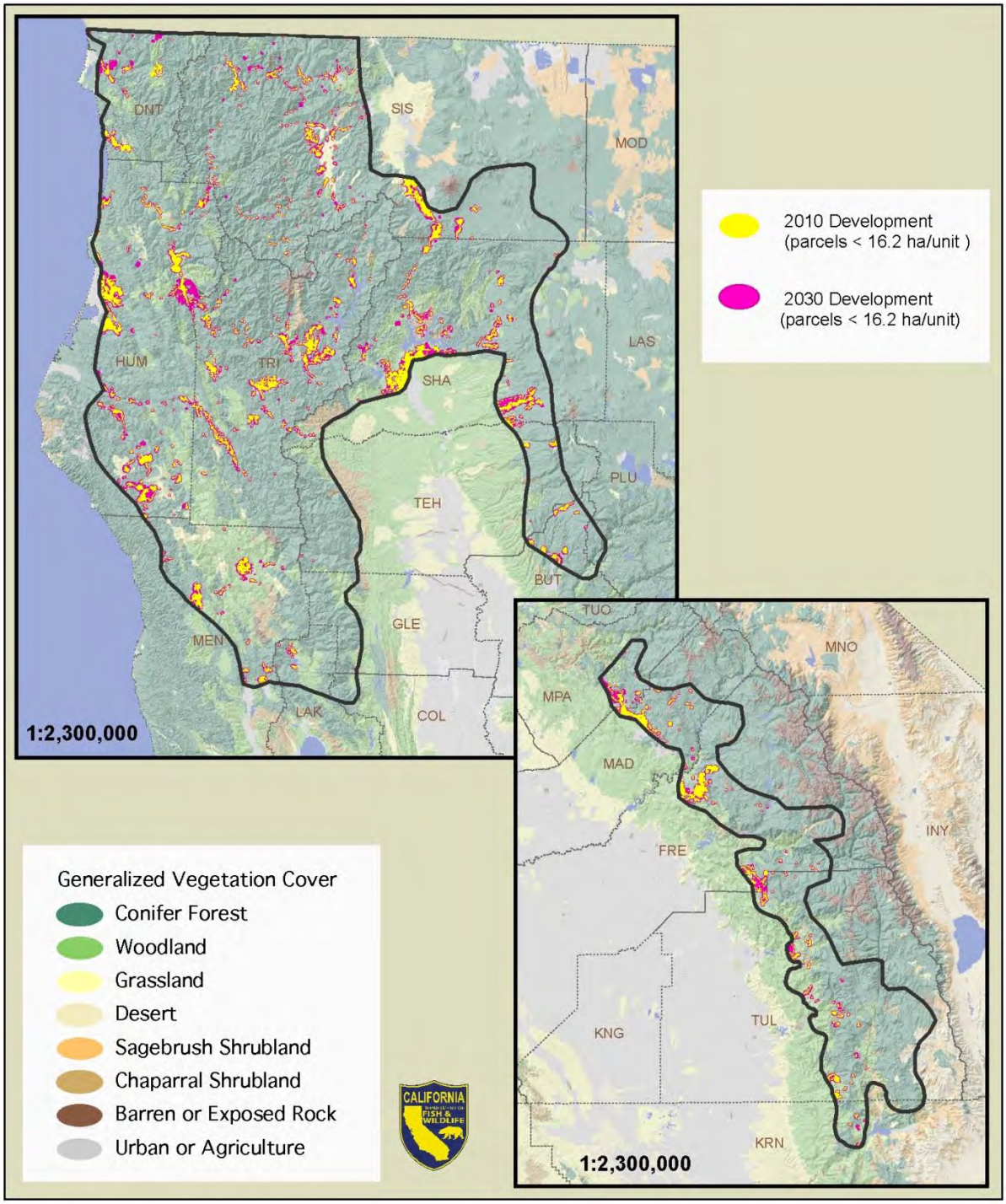

Figure 20. Area encompassed by human development (structures) on parcels less than 16.2 ha (40 ac) as of 2010 and projected to occur by 2030 within the Northern California Fisher Evolutionarily Significant Unit and the Southern California Fisher Evolutionarily Significant Unit. Areas of contemporary and projected development were based on Theobald (unpublished data). California Department of Fish and Wildlife, 2014.

Table 1. Area encompassed by human development (structures) on parcels less than 16.2 ha (40 ac) as of 2010 and projected by 2030 within the Northern California Fisher Evolutionarily Significant Unit (NC ESU) and the Southern Sierra Fisher Evolutionarily Significant Unit (SSN ESU). Areas of contemporary and projected development were based on Theobald (unpublished data).

	Square Kilometers (Square Miles)				
Evolutionarily Significant Unit	Total Area	Contemporary Development (2010)	Percent of ESU	Projected Development (2030)	Percent of ESU
NC ESU	41,036 (15,844)	1,298 (501)	3%	1,608 (621)	4%
SSN ESU	7,783 (3,005)	324 (125)	4%	358 (138)	5%

Table 2. Potential fisher habitat modified by human development (structures) on parcels < 16.2 ha (40 ac) as of 2010 and projected by 2030 within the Northern California Fisher Evolutionarily Significant Unit (NC ESU) and the Southern Sierra Nevada Fisher Evolutionarily Significant Unit (SSN ESU). Fisher habitat suitability (low, intermediate, and high) was predicted using a habitat model developed by the US Fish and Wildlife Service and the Conservation Biology Institute. Areas of contemporary and projected development were based on Theobald (unpublished data).

	Square Kilometers (Square Miles)					
Evolutionarily Significant Unit	Low	Percent of ESU	Intermediate	Percent of ESU	High	Percent of ESU
NC ESU (2010)	560 (216)	1.4%	331 (128)	0.8%	398 (154)	1.0%
NC ESU (2030)	699 (270)	1.7%	420 (162)	1.0%	480 (185)	1.2%
SSN ESU (2010)	119 (46)	1.5%	42 (16)	0.5%	162 (63)	2.1%
SSN ESU (2030)	142 (55)	1.8%	48 (18)	0.6%	162 (65)	2.2%

Roads: Fishers occupying habitats containing roads occasionally are killed by vehicles (Krohn et al. 1994:140, York 1996:25, Truex et al. 1998:34, Powell et al. 2013:27, Spencer et al. 2015:68). Researchers following radio-collared fishers have reported the loss of some study animals due to collisions with vehicles and road-killed fishers are occasionally reported to the Department as incidental observations (CDFW unpublished data). Of 81 mortalities of fishers documented by the Sierra Nevada Adaptive

Figure 21. Fisher obtaining food near human residences in Shasta County on June 16, 2012. Photo credit: Jim Sartain.

Management and the Kings River Fisher projects, 3.7% were attributed to animals being killed by vehicles on roads (Spencer et al. 2015:13).

The probability of a fisher being struck by a vehicle increases as a function of road density within its home range, vehicle speeds, and traffic levels. Mortalities are likely to be lowest on rural roads because the traffic is relatively light and traffic speeds are comparatively low. In contrast, the probability of fishers being killed on highways is likely higher because of speed and higher levels of traffic. Although roads are a source of mortality for fishers in California and have been hypothesized to be a potential barrier to dispersal (Aubry et al. 2004:204, Lofroth et al. 2010:52, Garroway et al. 2011:3979), they have not been demonstrated to limit fisher populations. Roads have not been shown to be barriers to dispersal or movement of fishers in areas where they have been reintroduced to the northern Sierra Nevada or studied in northern Siskiyou County (Powell et al. 2013:37). In the southern Sierra Nevada, Tucker (2013*a*:66) found that roads and large water bodies impeded gene flow for female fishers.

Disturbance: Although fishers may be active throughout the day and night, they are seldom seen. This is due, in part, to the relatively remote forested habitats typically occupied by fishers. Human-caused disturbance to fishers may occur due to noise or

actions that alter habitats occupied by fisher. Fishers occupy a relatively wide elevational range in California and many forms of human activity occur in these areas (e.g., logging, fire management, mining, hiking, hunting, horseback riding, and off road vehicles).

Reproductive female fishers with dependent young are potentially more susceptible to disturbance than adult male fishers or juvenile fishers because they must shelter and provision their kits in dens. Although female fishers readily move their kits to alternate dens, this requires energy and the risk of predation may be relatively high when transporting kits to new den sites. Before the kits are old enough to be able to follow their mother independently, she must carry them in her mouth out of their den and for some distance to a new den site. Kits are typically carried singly; therefore this may require multiple trips to shift den locations.

The effects of disturbance to fishers using dens have not been well studied; however, monitoring radio-collared females with young provides some insight into their sensitivity to some human activity. Researchers frequently monitor the activities of female fishers at dens. This may include multiple visits to den sites to set infrared cameras to document reproduction, listen for the presence of kits, and in some cases temporarily remove kits from their dens to be counted and marked for later identification. These relatively invasive activities have become increasingly common since the 1990s as interest in fishers has grown and monitoring techniques have improved. Although researchers exercise care to minimize disturbance, it is likely that their presence at the den is recognized by female fishers. Despite the potential for these activities to result in abandonment of kits, it has rarely been documented.

Timber management activities may disturb fisher foraging, resting, or reproductive activities. This may include disturbance due to noise associated with logging, or the cutting of den or rest trees occupied by fishers. Nevertheless, timber management activities generally occur infrequently and stands are left largely undisturbed between harvest entries. To evaluate the rate of timber harvest on private lands in the Department's Northern Region (nine northern counties in California), its Timber Conservation Planning Program totaled silvicultural treatments approved under timber harvest plans by planning watershed. Those values were used to calculate the percentage of each watershed harvested from 2002 through 2012. On average, 9.7 %

of each watershed within the area assessed was harvested during this ten-year period (0.97% annually).

Fishers have been known to occupy habitats in the immediate vicinity of active logging operations, suggesting that the noises associated with these activities or their perceived threat did not result in either displacement or territory abandonment (CDFW, unpublished data). Recreational use of habitats occupied by fishers in California is likely higher on public lands than private lands managed for timber production. Despite the intense use some public lands receive, the majority of recreational human activity occurs near roads, trails, and specific points of interest (e.g., lakes). Fisher home ranges are typically large and are generally characterized by steep, heavily vegetated, rugged terrain and the likelihood that recreation by humans would occur for sufficient duration to substantially disrupt essential behaviors of fishers (e.g., breeding, feeding) is low.

Overexploitation

Fishers are relatively easy to capture and, when legally trapped as furbearers in California, their pelts were valuable (Lewis and Zielinski 1996). The first regulated trapping season occurred in 1917, and the annual fee for a trapping license from 1917 to 1946 was $1.00. Due to their high commercial value, fishers were specifically targeted by trappers (Grinnell et al. 1937) and were also likely harvested by trappers seeking other furbearers (Lewis and Zielinski 1996).

Since the mid-1800s, the distribution of fishers in North America contracted substantially, due in part to over-trapping and mortality from predator control programs (Lewis et al. 2012:1). Over-trapping of fishers has been considered a significant cause of the species' decline in California (Grinnell et al. 1937:229). By the early 1900s, relatively few fisher pelts were sold in California. Only 28 fishers were reported trapped during the 1917-1918 license year when nearly 4,000 licenses were sold. Interestingly, even as late as 1919-1920, rangers in Yosemite trapped 12 fishers and 102 were reported to have been taken statewide that season (Grinnell et al. 1937:228). Although not all trappers sought fishers, those trapping in areas where they occurred likely considered fishers a prize catch.

The high value trappers obtained for the pelts of fishers in the early 1900s, the vulnerability of fishers to trapping (Douglas and Strickland 1987:523), and the lack of harvest regulations resulted in unsustainable exploitation of fisher populations (Lewis et al. 2012). Fishers were considered to be rare in California by the early 1920s (Dixon 1925:23). Despite being the most valuable furbearer in California at the time, the reported take by trappers during a 5-year period (1920-1924) was only 46 animals (Grinnell et al. 1937:228).

Concern over the decrease in the number of fishers trapped in California led Joseph Dixon in 1924 to recommend a 3-year closed season to the legislative committee of the State Fish and Game Commission (Dixon 1925:25). Grinnell et al. (1937:230) considered the complete closure of the trapping season for fishers or the establishment of local protection through State Game Refuges necessary to ensure the future of the fisher in California. He and his colleagues were optimistic that trappers would be among the first to favor protection for fishers if presented with factual information fairly, and believed that fur buyers would support any conservation measure that would ensure a future supply of revenue. Despite concerns about the scarcity of fishers in the state by Dixon and others, trapping of fishers was not prohibited until 1946 (Gould 1987). Although commercial trapping of fishers was prohibited, commercial trapping of other furbearers with body gripping traps in California continued.

The incidental capture of fishers in traps set for other species has been well described in the literature. Captured fishers frequently died as a result (Lewis and Zielinski 1996:295). Fishers held by body gripping style traps may die from exposure to weather and stress, be killed by other animals including other fishers (Douglas and Strickland 1987:520), or may be injured attempting to escape. In addition, fishers are quick and powerful animals, and releasing one held in a leg-hold trap unharmed would be challenging. Some trappers may have simply killed and discarded fishers when their pelts could not be sold, or injured animals in the process of releasing them to avoid being bitten (R. Callas, unpublished data). The level of mortality of fishers incidentally captured by trappers using body gripping traps has been considered to be a potential factor that may have negatively affected populations (Douglas and Strickland 1987:526) and slowed the recovery of fisher numbers in California after legal trapping was prohibited.

With the passage of Proposition 4 in 1998, body-gripping traps (including snares and leg-hold traps) were banned in California for commercial and recreational trappers (Fish & G. Code, § 3003.1). Licensed individuals trapping for purposes of commercial fur or recreation in California are now limited to the use of live-traps. Licensed individuals trapping for purposes of commercial fur or recreation in California are now limited to the use of live-traps. Licensed trappers are also required to pass a Department examination demonstrating their skills and knowledge of laws and regulations prior to obtaining a license (*Id*, § 4005). Fishers incidentally captured by trappers must be immediately released *(Id*, § 465.5(f)(1)).

The owners of traps or their designees are required by regulation to visit all traps at least once daily. When confined to cage traps, fishers may scratch and bite at the trap housing (typically made of wire or wood) in an effort to escape. In some cases, this has resulted in broken canines or damage to other teeth, but injuries of this nature, although undesirable, are likely not life-threatening (CDFW, unpublished data). Older adult fishers are frequently missing one or more canines, molars, or both and otherwise appear in good physical condition (CDFW, unpublished data).

The sale of trapping licenses in California has declined since the 1970s (Figure 22), indicating a decline in the number of traps in the field during the trapping season for other furbearers. The harvest, value of furs, and number of licenses sold varied greatly over the years. In 1927, license sales reached 5,243, but with the Depression and World War II, sales declined dramatically until about 1970 when the price of fur began to increase (Gould and Escallier 1989:1). From the early 1980s through the present, license sales have continued to decrease with average sales from 2000 to 2011 equaling about 150 per year.

Licensed nuisance/pest control operators are permitted to use body-gripping traps (conibear and snare) in California. Throughout most of the Sierra Nevada and a substantial part of the southern Cascades, such traps must be fully submerged in water. Where above-water body-gripping traps are used in fisher range, incidental capture and take could occur. However, licensed nuisance/pest control operators typically work in proximity to homes and residential areas and their likelihood of capturing fishers is low. The USDA Wildlife Services uses a variety of traps to assist landowners whose property (typically livestock) has been damaged by individuals of certain wildlife

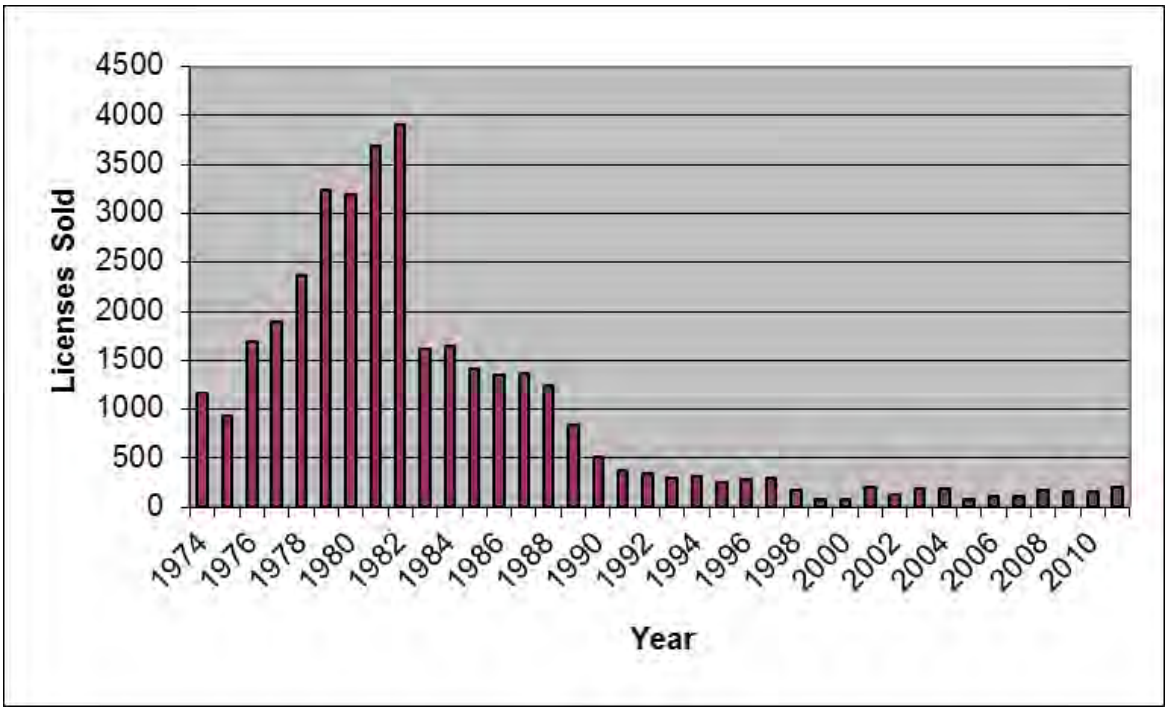

Figure 22. Trapping license sales in California from 1974 through 2011(CDFW Licensed Fur Trapper's and Dealer's Reports, http://www.dfg.ca.gov/wildlife/hunting/uplandgame/reports/trapper.html).

species; fishers cannot be taken under these circumstances and are not commonly associated with causing damage to property (CDFW, unpublished data).

Predator control and poisoning efforts, including those for porcupines, may have also impacted fisher populations (Douglas and Strickland 1987:512, 526, Aubry and Lewis 2003:81–82). The distribution of poison to control squirrels, coyotes, and other predators was common throughout much of California in the early part of the 20th century (Linsdale 1931, 1932). Linsdale (1932) summarized the reported observations of 285 people regarding the birds or mammals killed during California pest control campaigns in the 1920s and early 1930s. The summary included six observations of poisoned fishers at locations in Glenn, Tehama, and Shasta counties. One observer remarked "I lived on Log Spring Ridge in the coast mountains of Tehama County since 1919, and the coyote poison campaign has reduced the fur bearers to nothing along the poison line and for one mile or more on each side. Before 1924 I would see a fisher track often but now never see one. Lost two dogs in 1930, because poisoner left poison after season was over".

Efforts to control porcupines in California were widespread in the 1950s and often involved the placement of strychnine-salt blocks in boxes attached to trees (USDA Forest Service 1959). Strychnine baits sometimes incidentally kill non-target mammals (Anthony et al. 1984, Proulx 2011), and some captive mink died after consuming parts of strychnine-killed ground squirrels (Anthony et al. 1984). Anthony et al. (1984) concluded that a mink, marten, or fisher that consumed the stomach contents of a strychnine-killed ground squirrel could be at risk of poisoning.

Predation

Predation appears to be the most significant cause of mortality for fishers in California. In the southern Sierra Nevada, 69% of fisher mortalities at the Sierra Nevada Adaptive Management Program site and 90% of mortalities at the Kings River Fisher Project Site were due to predation. DNA amplified from 50 predated fisher carcasses from Hoopa, Sierra Nevada Adaptive Management Project and King's River projects identified bobcats (*Lynx rufus*) as the primary predator (50%). Mountain lions (*Puma concolor*) also killed a significant number of fishers (40%). Coyotes (*Canis latrans*) killed 8% of the predated fishers. One fisher carcass had both bobcat and mountain lion DNA (Wengert et al. 2014). The relative frequencies of mountain lion and bobcat predation did not differ among the three populations studied but did differ by sex. Bobcats killed only female fishers, whereas mountain lions more frequently preyed upon male than female fishers. Coyotes killed an equal number of male and female fishers (Wengert et al. 2014). This finding suggests that female fishers suffer greater predation from smaller predators than male fishers, and that predation risk overall is higher for female fishers. Predation risk for females also varied seasonally: over 70% (19 of 25) of female predation deaths by bobcats occurred late March through July, the period when fisher kits are still dependent on their mothers for survival (Higley et al. 2013:35, Wengert et al. 2014).

The proportion of fisher mortalities caused by predation found by Wengert et al. (2014) was higher than previously reported in California (Buck 1982) and British Columbia (Weir and Corbould 2008). Powell and Zielinski (1994) suspected that significant rates of predation of healthy adults would occur mainly in translocated fisher populations, but the findings in Wengert et al. (2014) indicate that predation is a significant mortality

factor for native fisher populations in California. Some forest management practices favor species adapted to disturbed and early seral habitats, some of which are known to prey on fishers (e.g., bobcat, mountain lion). Wengert (2013:99) found that proximity to open and brushy habitats heightened the risk of predation by bobcats on fishers and hypothesized that this may increase when fishers venture into habitat types they do not frequently visit.

Competition

The relationships between fishers and other carnivores where their ranges overlap are not well understood (Lofroth et al. 2010:10). Throughout their range, fishers potentially compete with a variety of other carnivores including coyotes, foxes, bobcats, lynx, American martens, weasels (*Mustela* spp.), and wolverines (Powell and Zielinski 1994, Campbell 2004, Lofroth et al. 2010). Fishers likely compete for resources most intensely with other species of forest carnivores of similar size (e.g., bobcats, gray fox). Fishers may also compete with raptors for certain prey, including the barred owl that has increased significantly in California.

Campbell (2004) compared assemblages of carnivores in the southern Sierra Nevada where fishers occur and in the central Sierra Nevada where they are believed to be absent. She hypothesized that the absence of fishers in the northern and central Sierra Nevada was due to a lack of suitable habitat or to negative interactions with other carnivores. Opossum, gray fox, and striped skunk were detected at sampling stations more frequently outside of the fisher occupied area and suggested this difference may have been due to habitat conditions at those sites being less favorable for fishers (Campbell 2004). She also concluded that elevated densities of species such as gray fox and striped skunk may hinder the recolonization of fishers to portions of their former range. However, fishers translocated to the northern Sierra Nevada in 2009-2011 now co-occur with a number of other carnivore species including raccoon, gray fox, ringtail, spotted skunk, bobcats, and opossum. Fishers are now established within the translocation area and have been live-trapped annually for study after the translocation. Live-trapping occurs in the fall and during two of three years (2012 and 2014) fishers were the most frequently captured carnivore (A. Facka, unpublished data). Spotted skunks were captured at a slightly higher rate than fishers in 2013.

The relative similarities in body size, body shape, and prey between fishers and martens suggest the potential for competition between these species (Lofroth et al. 2010:10). In California, martens often occur at higher elevations than fishers; this spatial separation may minimize competition between the two species in many areas. Where fishers and martens are sympatric, fishers likely dominate interactions between the species because of their larger body size.

Little is known regarding the potential risks to fisher populations from competition with other carnivores. Fisher have long coexisted with a suite of other carnivores and, with the exception of the wolverine, these potential competitors remain within habitats occupied by fishers in California.

Disease

A number of viral, bacterial, and parasitic diseases have been documented in fishers. Canine distemper virus infection, a cause of significant morbidity and mortality in other carnivore populations (Williams 2001), was associated with the death of four radio-collared fishers from the southern Sierra Nevada population in 2009 (Keller et al. 2012). Canine distemper virus causes lethargy (weakness), disorientation, pneumonia and other neurologic signs (tremors, seizures, circling) which could predispose an animal to predation or compromise an animal's ability to survive a capture and immobilization event.

In California, mortalities in gray foxes and raccoons caused by canine distemper are common (D. Clifford, CDFW; UC Davis, unpublished data). Both of these species frequently occur in habitats used by fishers. Although the solitary nature of the fisher may lower disease transmission (and thus large-scale outbreak) risk, canine distemper has been responsible for the near extirpation of other small carnivore populations including black-footed ferrets (*Mustela nigripes*) (Williams et al. 1988) and Santa Catalina Island foxes (*Urocyon littoralis catalinae*) (Timm et al. 2009). Furthermore, highly virulent biotypes of canine distemper can be transmitted and cause high mortalities in multiple carnivore species (Origgi et al. 2012).

Although canine distemper can cause mortalities in fishers, antibodies against this disease have been detected in a small number of apparently healthy live-captured individuals in California, indicating that some fishers can survive infection (Table 4). Of

98 fishers sampled from the Hoopa Valley Indian Reservation population, five animals (5%) had antibodies to canine distemper (Gabriel et al. 2010). From 2007 to 2009 in the southern Sierra Nevada, 14% (five out of 36) of sampled fishers on the Kings River Fisher Project and 3% (one out of 36) of sampled fishers in the Sierra Nevada Adaptive Management Project area were exposed to canine distemper (Gabriel et al. 2010). Evidence to date and experiences with other species underscore the fact that canine distemper has potential to be a pathogen of conservation concern for fishers in California, and that risk is increased in populations that are small and fragmented.

Deaths due to rabies and canine parvovirus, both potentially significant pathogens for *Martes* species (Gabriel et al. 2012*b*), have not been documented in fishers in California. Virus shedding[38] of canine parvovirus however, has been documented in fisher (Gabriel et al. 2010), and clinically significant illness due to the virus was observed in a fisher (D. Clifford, CDFW unpublished data). Fishers inhabiting lands on the Hoopa Valley Tribal Reservation in northwestern California are commonly infected with canine parvovirus: 28 of 90 (31%) fishers tested in 2004-2007 had antibodies to the virus present in their plasma (Table 3).

Fishers in California are commonly exposed to *Toxoplasma gondii,* an obligate intracellular parasite that has caused mortality in captive black-footed ferrets (*Mustela nigripes*) and other mustelids (Burns et al. 2003), American minks (*Mustela vision*) (Pridham and Belcher 1958), and southern sea otters (*Enhydra lutris*) (Cole et al. 2000, Kreuder et al. 2003:504). Mortality in fishers resulting from infection with *Toxoplasma gondii* has not been documented. Exposure prevalence for fishers sampled in California ranged from 11-58%, and both the northern California and southern Sierra Nevada fisher populations were exposed (Table 3). Exposure to *T. gondii* was also common in fishers in Pennsylvania (Larkin et al. 2011).

California fishers have been exposed to two vector-borne pathogens, *Anaplasma phagocytophilum* and *Borrelia burgdorferi sensu lato* (bacteria that causes lyme disease) (Brown et al. 2008), but mortalities of fishers from these diseases have not been reported.

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[38] Viral release following reproduction in a host-cell.

Table 3. Prevalence of exposure to canine distemper, canine parvovirus, and toxoplasmosis in fishers in California based on samples collected in various study areas from 2006 to 2009 (Gabriel et al. 2010).

	Canine Distemper Percent (No. sampled)	Canine Parvovirus Percent (No. sampled)	*Toxoplasma gondii* Percent (No. sampled)
Hoopa	5% (98)	31% (90)	58% (77)
North Coast Interior	--	11% (19)	46% (13)
Sierra Nevada Adaptive Management Project	3% (36)	4% (24)	66% (33)
USFS (southern Sierra Nevada)	14% (36)	47% (19)	55% (39)

Plague is known to cause mortality in other mustelids, is a serious zoonotic[39] risk (Williams et al. 1994) and is endemic in many parts of California. Fishers are likely susceptible to *Yersinia pestis*, the agent of plague, but no cases have been documented as causing mortality in fishers (Gabriel et al. 2012*b*).

Other documented disease-caused fisher mortalities have included: bacterial infections causing pneumonia, some of which were associated with the presence of an unknown helminth parasite; concurrent infection with the protozoal parasite *Toxoplasma gondii* and urinary tract blockage, and a case of cancer which caused organ failure (M. Gabriel, unpublished data).

Fishers harbor numerous ecto- and endoparasites. Although some parasites can serve as vectors for other diseases, infections and infestations are usually associated with minimal morbidity and mortality (Gabriel et al. 2012b). Banci (1989) noted fisher susceptibility to sarcoptic mange, and endo- and ectoparasites of fishers have been described by Powell (1993). Two parasitic infections have only recently been documented in California fishers. The eyeworm, *Thelazia californiensis,* was first found under the eyelids of multiple individuals from northern California in 2009 (D. Clifford, CDFW unpublished data). Although these worms may cause some irritation and eye

[39]Zoonotic diseases are contagious diseases that can spread between animals and humans.

damage, there were no vision deficits or eye damage noted in these affected fishers. *T. californiensis* most often infects livestock and is transmitted by flies that mechanically transport eyeworm eggs among animals while feeding on eye secretions (Weinmann et al. 1974).

In 2010, trematode flukes and eggs were recovered from five fishers from Humboldt County that were noted to have severe peri-anal swellings and subcutaneous abscesses during their immobilization examination (Clifford et al. 2012). Retrospective analysis of field observations revealed that similar peri-anal swelling and abscesses were occasionally noted on fishers immobilized as part of the Hoopa Fisher Project (Higley, unpublished data). No mortalities have been attributed to this novel trematode infection (L. Woods, unpublished data), but it is not known if fishers with severe disease suffer morbidity or reduced long term survival.

Toxicants

Fishers in California are frequently exposed to, and sometimes killed by, rodenticides (Gabriel et al. 2012*b*, Thompson et al. 2013). Large amounts of pesticides, including anticoagulant rodenticides, have been found in recent years at illegal marijuana cultivation sites on public, private, and tribal forest lands[40], and some researchers have suggested that such grow sites are the likely source of fisher exposure to toxicants (Gabriel et al. 2013, Thompson et al. 2013). Rodenticides were found at marijuana cultivation sites in the 1980s and 1990s (M. Gabriel, pers. comm.), but the extent and distribution of their use was not documented. Challenges to investigating toxicant threats from marijuana cultivation sites within fisher range include the illegal nature of growing operations, lack of resources to conduct field studies, the necessity of law

[40] Marijuana cultivation has increased since the 1990s on both private and public lands. Cultivation on private lands appears to be increasing, in part, in response to Proposition 215, the Compassionate Use Act of 1996 which allowed for legal use of medical marijuana in California. As grow sites are largely unregulated, compliance with environmental regulations regarding land use, water use, and pesticide use is frequently lacking. The High Sierras Trail Crew, a volunteer organization that maintains Sierra Nevada national forests, reported remediating more than 600 large-scale grow sites on just two of California's 17 national forests (Gabriel et al. 2013).

enforcement protection for field researchers, and difficulties in distinguishing toxicant-related effects from those resulting from other environmental factors (Colvin and Jackson 1991).

Fishers are opportunistic generalist predators and may be exposed to toxicants directly through consumption of flavored baits. Rodenticide baits flavorized to be more attractive to rodents (with such flavors as sucrose, bacon, fish, cheese, peanut butter, and apple) would likely appeal to fishers (Gabriel et al. 2012*c*). Furthermore, intentional wildlife poisoning has occurred through the distribution of food items such as canned tuna or sardines laced with pesticides (Gabriel et al. 2013). Fishers could also be exposed to toxicants secondarily through consumption of prey. This is likely the primary means of anticoagulant rodenticide exposure because of the toxicant's persistence in the body tissue of poisoned prey; secondary exposure of mustelids to anticoagulant rodenticides has occurred in rodent control operations (Alterio 1996). Tertiary anticoagulant rodenticide exposure to wildlife that consume carnivores (such as mountain lions) has also been proposed (Moriarty et al. 2012) and may be possible in fishers that eat smaller carnivores. Lastly, anticoagulant rodenticide exposure has been documented in both pre-weaned fishers and mountain lions, indicating either placental or milk transfer can occur (Gabriel et al. 2012*c*, Moriarty et al. 2012).

Anticoagulant rodenticides cause mortality by binding to enzymes responsible for recycling Vitamin K and thus impairing an animal's ability to produce several key clotting factors. Anticoagulant rodenticides fall into two categories (generations): first and second generation anticoagulant rodenticides. First generation rodenticides, developed in the 1940s, must be consumed for consecutive days by a rodent to achieve a lethal dose. First generation rodenticides have a lower ability to accumulate in biological tissue and are metabolized more rapidly (Fisher et al. 2003, Erickson and Urban 2004). There are currently 73 first generation rodenticide products registered in California (http://www.cdpr.ca.gov/docs/label/chemcode.htm).

Development of second generation rodenticides began in the 1970s as resistance to first generation products began to appear in some rodent populations. Second generation rodenticides have the same mechanism of action as first generation rodenticides, but have a higher affinity for the target enzymes, leading to a relatively greater toxicity and more persistence in biological tissues (half-life of 113 to 350 days)

(Fisher et al. 2003, Erickson and Urban 2004). A lethal dose may be consumed at a single feeding, but the lag time between ingestion and death allows the rodent to continue feeding, which leads to a higher concentration in body tissue. There are currently 76 second generation products registered in California containing the active ingredients brodifacoum, bromadiolone, difethialone, and difenacoum.

In 2009, an apparently healthy fisher being studied by the UC Berkeley Sierra Nevada Adaptive Management Project fisher research team was found dead (Thompson et al. 2013:2). This animal was determined to have died from acute anticoagulant rodenticide poisoning and this discovery prompted the testing of archived liver samples from fishers previously submitted for necropsy as well as samples from other fishers that died elsewhere in California (Gabriel et al. 2012*c*:2–3). Fifty-eight fishers that died from 2006 to 2011 were tested and 79% were determined to have been exposed to anticoagulant rodenticides. The number of different anticoagulant rodenticide compounds found in a single individual ranged from 0 to 4, with the average being 1.6, indicating that multiple compounds are used in environments inhabited by fishers (Gabriel et al. 2012*c*). Of the fishers that tested positive for rodenticide exposure, 96% were exposed to the more toxic second generation rodenticides and this exposure was geographically widespread (Gabriel et al. 2012*c*). As of early 2015, thirteen California fishers are known to have died from anticoagulant rodenticide poisoning and three fishers are known to have been killed by other toxicants (M. Gabriel, unpublished data).

In the Hoopa Valley in northern California, 5 of 17 male fisher mortalities from 2005 to 2013 resulted from poisoning (an equal number were confirmed or suspected of being predated) (Higley et al. 2013:62)[41]. The number of toxicant-caused mortalities has varied by location in the southern Sierra Nevada; despite six such mortalities at the Sierra Nevada Adaptive Management Program site, there have been zero within the Kings River Fisher Project site (even though a given fisher was estimated to have a much higher likelihood of encountering a trespass marijuana grow site in the Kings River area) (Sweitzer et al. In review *b*). Eleven of the 13 (85%) confirmed fisher deaths from anticoagulant rodenticides to date in California have been males (Gabriel, unpublished data). Potential causes for such a disparity may be related to greater

[41] As of early 2015, the deaths of seven male and one female fisher at Hoopa have been confirmed as resulting from poisoning.

primary exposure resulting from the comparatively larger ranges of male fishers than female fishers. Thus, male fishers may encounter more grow sites or experience greater secondary exposure by consumption of more prey than females due to greater energy needs (Sweitzer et al. In review*b*).

Predators with liver concentrations of anticoagulant rodenticides as low as 0.03 ppm (ug/g) have died as a result of excessive bleeding from minor wounds inflicted by prey (Erickson and Urban 2004). In California, levels of some anticoagulants in fishers on average exceeded that level. Gabriel et al. (2012*c*:5) reported levels in fishers of the anticoagulants brodifacoum and bromodiolone to average 0.22 ppm and 0.12 ppm, respectively. Accordingly, fishers exposed to anticoagulant rodenticides may be at risk of experiencing prolonged bleeding after incurring a wound during a missed predation event, during physical encounters with conspecifics (e.g., bite wounds inflicted during mating), or from minor wounds inflicted by prey or during hunting.

Although it is well documented that anticoagulant rodenticides used both legally and illegally have caused mortalities of non-target wildlife species, including fishers (Berny et al. 1997, Erickson and Urban 2004, Anderson et al. 2011, Ruder et al. 2011, Gabriel et al. 2012*c*), the question of whether lethal and sublethal exposure to anticoagulant rodenticides or other pesticides has the ability to impact fishers at the population-level has just begun to be assessed. These data do not currently exist for fishers, but evidence from laboratory and field studies in other species supports the premise that pesticide exposure can indirectly affect survival (Ahdaya et al. 1976, Grue et al. 1991, Martin and Solomon 1991, Gordon 1994, Li and Kawada 2006, Janeway et al. 2007, Riley et al. 2007, Vidal et al. 2009, Zabrodskii et al. 2012). Multiple studies have demonstrated that sublethal exposure to anticoagulant rodenticides or organophosphates may impair an animal's ability to recover from physical injury. Sublethal effects may also include increased susceptibility to disease (Riley et al. 2007), behavioral changes such as lethargy and slower reaction time which may increase vulnerability to predation and vehicle strikes (Cox and Smith 1992:165–170), and reduced reproductive success.

The indirect contribution of anticoagulant rodenticide exposure (and other pesticides found at marijuana cultivation sites) to mortality from other sources in fishers may be supported by the greater survival rate in female fishers that had fewer grow sites

located within their home ranges (Thompson et al. 2013:8). Anticoagulant related fisher mortalities were concentrated temporally from April to June, which is the denning period for fisher females (Gabriel et al. 2012*c*, Higley et al. 2013). This raises concerns that mothers could expose their kits to anticoagulant rodenticides through lactation and that mortalities of females would lead to abandonment and mortality of their kits. Studies have suggested that embryos are more sensitive to anticoagulants than are adults (Godfrey and Lyman 1980, Munday and Thompson 2003).

Higher anticoagulant related mortalities in spring may be a consequence of greater use of anticoagulant rodenticides to protect young marijuana plants from rodent damage than at other times of the year. Low birth weight, stillbirth, abortion, and bleeding, inappetence and lethargy of neonates have all been documented in other species as a result of exposure to anticoagulant rodenticides, but it is not known if any of these effects have occurred in fisher, nor does it appear that specific populations are experiencing noticeably poor reproductive success. Further investigation to determine if neonatal litter size and weaning success for females varies by the number of marijuana cultivation sites located within an individual's home range may start to address this question.

To estimate the extent of the current fisher range potentially impacted by illegal marijuana cultivation sites, the area surrounding illegal grow sites in 2010 and 2011 was buffered by 4 km (2.5 mi)[42] and that total area was compared to the area represented by the assumed current range of fishers in California. The area potentially affected by these sites over a 2-year period represented about 32% of the fisher range in the state (Figure 23) (M. Higley, unpublished data). Furthermore, a high proportion of grow sites are not eradicated and most sites discovered in the past were not remediated and hence may continue to be a source of contaminants.
Volunteer reclamation crews reported that anticoagulant rodenticide and other toxicants were found and removed from 80% of 36 reclaimed sites in National Forests in California in 2010 and 2011 (Thompson et al. 2013). Sixty-eight kilograms of anticoagulant rodenticide and other pesticides were removed from Mendocino National Forest during a removal of 630,000 plants in three weeks during 2011. Gabriel et al.

[42] A circle with a radius of 4 km (2.5 mi), approximates the size of an adult male fisher.

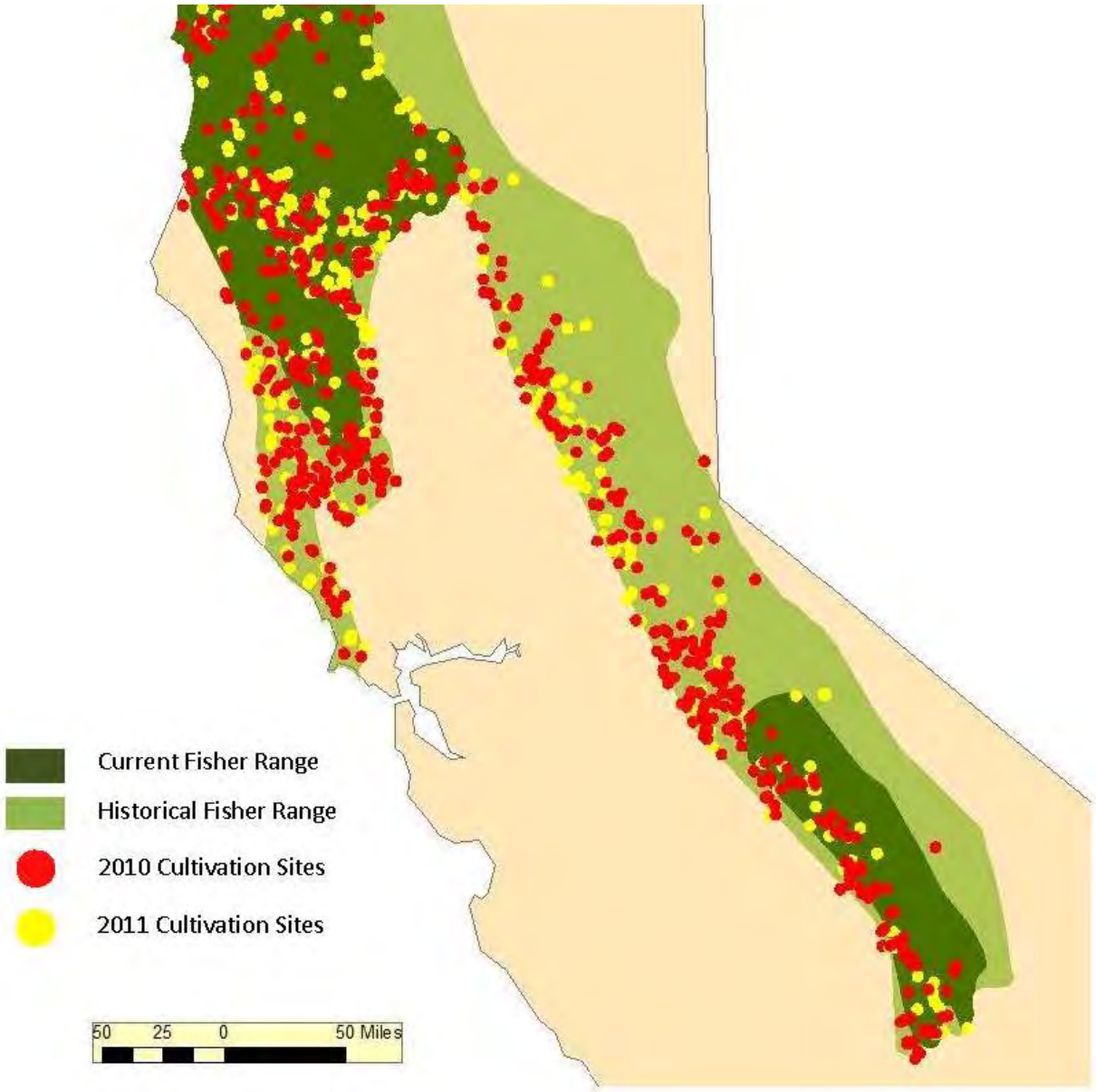

Figure 23. Cultivation sites eradicated on public, tribal or private lands during 2010 and 2011 within both historical and estimated current ranges of the fisher in California. Adapted from Higley, J.M., M.W. Gabriel, and G.M. Wengert (2013).

(2012*a*) documented the amount of toxicants found at one illegal marijuana cultivation site within occupied fisher territories in Humboldt County. In addition to an insecticide and a molluscicide, 0.68 kg (1.5 lbs) of the brodifacoum and empty containers once containing a total of 2.9 kg (6.5 lbs) of brodifacoum were found. Based on the LD50 value for a 5 kg domestic dog, it was estimated that this amount of material could kill between 4 and 21 fishers through direct consumption. Based on the LD50 value for mice, the same material could potentially kill over 9,000 mice. Those working to dismantle and remediate these sites report large numbers of pesticide containers (empty and full), but no organized data statewide have been collected to quantify usage. However, in the southern Sierra Nevada, trail crews reported finding second generation rodenticides at 50% or more of remediated marijuana cultivation sites (Gabriel et al. 2013:48).

Food containers that appear to have been spiked with pesticides and piles of bait have been found at grow sites indicating an intent to poison wildlife (Gabriel et al. 2013). In addition to being placed around young marijuana plants, pesticides are also often placed along plastic irrigation lines which often extend outside the perimeter of grow sites, increasing the area of toxicant use. An eradication effort on public lands involving multiple grow sites yielded irrigation lines extending greater than 40 km (Gabriel et al. 2012*c*). Three fishers in northern California were suspected to have died as a result of exposure to pesticides other than anticoagulant rodenticides: one death caused by the carbamate insecticide methomyl, one death caused by the rodenticide cholecalciferol, and one death caused by the rodenticide bromethalin (Gabriel, unpublished data).

Pests at marijuana cultivation sites include many species of insects and mites, as well as rodents, deer, rabbits, and birds (California Research Bureau 2012); a number of pesticides have been found at grow sites that were presumably used to combat them (Table 4). Some of the organophosphates and carbamates used at those sites are not legal for use in the U.S. because of mammalian and avian toxicity. Secondary exposure of carnivores and scavengers to one such illegal pesticide, carbofuran has also been reported worldwide and has been the result of both intentional poisoning and legal use (Jansman and van Tulden 2012, Mineau et al. 2012). Organophosphate and carbamate pesticides may cause immediate mortality making their detection difficult compared to toxicants that have sublethal effects and can be detected in animals that die from other causes months after exposure.

Table 4. Classes of toxicants and toxicity ranges of products found at marijuana cultivation sites (CDFW, Integral Ecology Research Center, High Sierra Volunteer Trail Crew, unpublished data). Some classes contain multiple compounds with many consumer products manufactured from them.

Class	Mammalian Toxicity Range	Relative Frequency of Occurrence at Marijuana Cultivation Sites [1]	Evidence of Exposure or Toxicity (Gabriel et al. unpublished)
Organophosphate Insecticides	Slight to Extreme	Common	Detected
Carbamate Insecticides	Moderate to Extreme	Common	Detected
Anticoagulant Rodenticides	Extreme	Common	Detected
Acute Rodenticides	High to Extreme	Occasional	Probable detections
Pyrethroid Insecticides	Slight	Common	Not Detected
Organochlorine Insecticide	Moderate	Occasional	Not Detected
Other Insecticides	Slight to Moderate	Occasional	Not Detected
Fungicide	Slight	Common	Not Detected
Molluscicide	Moderate	Common	Not Detected

[1]Relative frequency of occurrence was rated as “occasional” or “common” based on the highest occurrence for any product in each class.

Pesticide-caused mortality and exposure prevalence should be considered minimum estimates because poisoning cases and sublethal exposures in unmonitored populations are unlikely to be detected. Despite these limitations, Thompson et al. (2013) found a “strong but speculative” association between illegal marijuana cultivation, anticoagulant rodenticide exposure, and fisher mortality fisher survival in the southern Sierra Nevada. For one measure of home range (95% adaptive kernel), female fisher survival was related to the number of marijuana cultivation sites the animal was likely to encounter. For another measure of home range (100% minimum convex polygon using locations from the last six months of life), females with documented exposure to anticoagulant rodenticides had more cultivation sites within their home ranges than females without exposure. (Thompson et al. 2013). They reported finding evidence that the survival of female fishers was related to the number of marijuana cultivation sites females were likely to encounter and that such exposure may predispose them to death from other causes (Thompson et al. 2013:6).

At the Sierra Nevada Adaptive Management Project site, the direct effect of toxicant poisoning was relatively small compared to other sources of mortality (Sweitzer et al. In review*b*). Predators removed 10 times as many fishers (both genders) and 41 times as many female fishers each year than the combined effect of anticoagulant rodenticides and vehicle strikes. In the absence of all fisher deaths from toxicants as well as disease, injury, and vehicle strikes, the base population growth rate within the Adaptive Management Program area was only estimated to increase 1%. These results notwithstanding, the prevalence of anticoagulant rodenticide exposure throughout the state and documented mortalities within both ESUs indicate that toxicants are a potentially significant threat that should be closely monitored.

Reductions in prey availability due to pesticide use at marijuana cultivation sites could potentially impact fisher population vital rates (e.g., births and deaths) through declines in fecundity or survivorship, or both. Because pesticides are often flavorized with an attractant (Erickson and Urban 2004), there is potential that grow sites could be localized population sinks for small mammals. Prey depletion has been associated with predator home range expansion and resultant increase in energetic demands, prey shifting, impaired reproduction, starvation, physiologic (hematologic, biochemical and endocrine) changes and population declines in other species (Knick 1990, Knick et al. 1993, Karanth et al. 2004, Hayward et al. 2012). Nevertheless, the level of small mammal mortality at marijuana cultivation sites remains unknown, thus, evidence for prey depletion or sink effects, as well as secondary impacts to carnivore populations dependent upon those prey is also unknown.

On July 1, 2014, second generation products containing brodifacoum, bromadiolone, difenacoum, and difethialone were designated as restricted materials in California and can only be sold by licensed dealers and purchased by certified applicators (Prichard 2014). The placement of second generation rodenticide bait will generally be prohibited more than 15 m (50 ft) from man-made structures (CCR, Title 3, § 6471(a)). These new regulations will limit the legal availability of second generation rodenticides, but they may still be obtained outside of California.

It is likely that, with second generation products no longer legally available to the public, other rodenticides that can be purchased by the general public will more frequently be used at marijuana cultivation sites. These could include products containing first

generation anticoagulants as well as bromethalin (a neurotoxin). Given the lower toxicity and persistence of first generation products compared to second generation products, there should be no increase in the exposure of fishers to anticoagulants. However, an increase in the amount of bromethalin used on sites may result in an increase in fisher mortalities due to its high toxicity.

Climate Change

Extensive research on global climate has revealed that temperature and precipitation have been changing at an accelerated pace since the 1950s (Pachauri and Reisinger 2007, Solomon et al. 2007). Average global temperatures over the last 50 years have risen twice as rapidly as during the prior 50 years (Lawler et al. 2012:372). Although the global average temperature is expected to continue increasing over the next century, changes in temperature, precipitation, and other climate variables will not occur uniformly across the globe (Pachauri and Reisinger 2007:8, 10, 13).

In California, temperatures have increased, precipitation patterns have shifted, and spring snowpack has declined relative to conditions 50 to 100 years ago (Bonfils et al. 2008:S49, Tingley et al. 2012:8–9). Current modeling suggests these trends will continue. Annual average temperatures are predicted to increase approximately 2.4 C by the 2060s (Pierce et al. 2013*b*:6) and 2-5 C by 2100 (Cayan et al. 2012:5). Projections of precipitation patterns in California vary, but most models predict an overall drying trend with a substantial decrease in summer precipitation (Hayhoe et al. 2004, Christensen et al. 2007, Littell et al. 2011). Conversely, the Mt. Shasta region may experience more variable patterns and a possible increase in precipitation (Cayan et al. 2009). Extremes in precipitation are predicted to occur more frequently, particularly on the north coast where precipitation may increase and in other regions where the duration of dry periods may increase (Pierce et al. 2013*a*, *b*). Warming temperatures have caused a greater proportion of precipitation to fall as rain rather than snow, earlier snowmelt, and reduced snowpack (Halofsky et al. 2011). These patterns are expected to continue (Hayhoe et al. 2004, Salathe et al. 2010, Littell et al. 2011, Cayan et al. 2012) and Sierra Nevada snowpack is predicted to decline by 50% or more by 2100 (Ralph 2011). Forests throughout the state will likely become more dry (Halofsky et al. 2011, Littell et al. 2011, Cayan et al. 2012).

Warming is predicted throughout the range of the fisher in California (Lawler et al. 2012:374). Pierce et al. (2013*b*) projected warmer conditions (2.6 C increase) for inland portions of California compared to coastal regions (1.9 C increase) in the state by 2060. Therefore, fishers inhabiting the SSN ESU may experience greater warming than those occupying portions of the NC ESU. The changing climate may affect fishers directly, indirectly, or synergistically with other factors. Fishers may be directly impacted by climate changes as a warmer and drier environment may cause thermal stress. Fishers in California often rest in tree cavities, and in the southern Sierra Nevada, rest sites are often located near water (Zielinski et al. 2004*b*). Zielinski et al. (2004*b*:488) suggested fishers may frequent such structures and settings in order to minimize exposure to heat and limit water loss, particularly during the long hot and dry seasons in California. The effect of increasing temperatures, shifting precipitation patterns, and reduced snowpack on fisher fitness may depend, in part, on their ability to behaviorally thermoregulate by seeking out cooler microclimates, altering daily activity patterns, or relocating to cooler areas (potentially at higher elevations) during warmer periods. Deep snow has been hypothesized to limit the distribution of fisher populations (Krohn et al. 1997:212). Fishers occur in areas associated with low to intermediate snowfall across a wide range of forest types (Krohn et al. 1997:226) and reductions in snowpack associated with climate changes may allow fishers to exploit habitats at higher elevations than are typically used.

Bioclimatic models (models developed by correlating the current distribution of the fisher with current climate) applied to projected future climate (using a medium-high greenhouse-gas emissions scenario) suggest that fishers may lose most of their "climatically suitable" range within California by the year 2100 (Lawler et al. 2012:379). However, the distribution and climate data for those models was assessed using a grid constructed of 50 x 50 km cells; at that scale the projections are influenced by topographic features such as large mountain ranges, but they are not substantially affected by fine-scale topographic diversity (e.g., slope, aspect, and elevation diversity within each grid cell). Because of the topographic diversity in California's montane environments, temperature and other climatic variables can change considerably over relatively small distances (Loarie et al. 2009). Thus, the diversity of the physical environment within areas occupied by fishers may buffer some of the projected effects of a changing climate (Moritz and Agudo 2013:504).

Climate change is likely to affect fishers indirectly by altering the species composition and structural components of habitats used by fishers in California (Lenihan et al. 2003, Lawler et al. 2012). Climate change may also interact synergistically with other potential threats such as fire; it is likely that fires will become more frequent and potentially more intense as the California climate warms and precipitation patterns change (Fried et al. 2004:179, Westerling et al. 2006:942–943, Lawler et al. 2012:385–388). To evaluate future climate-driven changes to habitats used by fishers in the state, Lawler et al. (2012:384) combined model projections of fire regimes and vegetation response in California by Lenihan et al. (2003) with stand-scale fire and forest-growth models. Interactions between climate and fire were projected to cause significant changes in vegetation cover in both fisher ESUs for the period 2071-2100, as compared to mean vegetative cover from 1961 to 1990 (Table 5).

In the Klamath Mountains, the primary predicted change is an increase in hardwood cover and a likely decrease in canopy cover (exemplified by reduced conifer forest cover and increased mixed forest and mixed woodland cover). In the southern Sierra Nevada, the predicted changes are similar (more hardwood cover and less canopy cover) but also include substantial reduction in the amount of forested habitats and a concomitant increase in the amount of grasslands (Lawler et al. 2012:387). Hayhoe et al. (2004:12427) modeled California vegetation over the same period as Lawler et al. (2012) and also concluded that widespread displacement of conifer forest by mixed evergreen forest is likely by 2100. Shaw et al. (2011:S472–S474) predicted substantial losses of California conifer forest and woodlands and, in general, increases in hardwood forest, hardwood woodlands, and shrublands by 2100.

If woodlands and grasslands within the fisher ESUs expand considerably as a result of climate change, the loss of overstory cover may reduce suitability of some areas and render others completely unsuitable. Lawler et al. (2012:394) also suggested that projected increases in mixed-evergreen forests resulting from a warming climate could enhance the “floristic conditions” for fisher survival (as long as other factors do not cause fishers and their prey to migrate from these areas), presumably due to the frequent use of hardwood trees for denning and resting. Lastly, Lawler et al. (2012:385) cautioned that fisher habitat quality depends primarily on vegetation and landscape features occurring at finer spatial scales than used in their model. They further noted that the modeled changes are broad, landscape-scale patterns that will be

Table 5. Approximate current (1961-1990) and predicted future (2071-2100) vegetation cover in the Klamath Mountains and southern Sierra Nevada, as modeled by Lawler et al. (2012).

Klamath Mountains - land cover percentages					
	Current	**Future**			
		Model 1	Model 2	Model 3	Average
Evergreen conifer forest	66	30	26	14	23
Mixed forest	23	51	51	51	51
Mixed woodland	8	16	20	30	22
Shrubland	0	1	1	3	2
Grassland	3	2	2	2	2
TOTAL	100	100	100	100	100

Southern Sierra Nevada - land cover percentages					
	Current	**Future**			
		Model 1	Model 2	Model 3	Average
Evergreen conifer forest	40	31	21	10	21
Mixed forest	2	15	5	2	7
Mixed woodland	25	34	36	37	36
Shrubland	16.5	2	3	8	4
Grassland	16.5	18	35	44	32
TOTAL	100	100	100	101	100

"filtered" by variability in topography, vegetation and other factors. In the southern Sierra Nevada, Koopman et al. (2010:21–22) modeled vegetation and predicted that although species composition would change, needleleaf forests would still be widespread in 2085. Koopman et al. (2010:21–22) also stressed that decades or centuries may be required for substantial vegetation changes to occur, particularly in forested areas. Burns et al. (2003) assessed potential changes in mammalian species composition within several National Parks resulting from a doubling of the baseline atmospheric CO_2 concentration. Although the results indicated that fishers were among the most sensitive of the modeled carnivores to climate change, they were predicted to continue to occupy Yosemite National Park. Burns et al. (2003:11476) suggested that the most noticeable effects of climate change on wildlife communities may be a fundamental change in community structure as some species emigrate from particular areas and other species immigrate to those same areas. Such "reshuffling" of

communities would likely result in modifications to competitive interactions, predator-prey interactions, and trophic dynamics. The potential effects, positive or negative, of such community restructuring on fishers, their prey, and their predators remain unknown.

Warmer temperatures may also result in greater insect infestations and disease, further influencing habitat structure and ecosystem health (Littell et al. 2010, Spies et al. 2010, Halofsky et al. 2011). Winter insect mortality may decline and some insects, such as bark beetles, may expand their range northward (Trần et al. 2007, Paradis et al. 2008, Safranyik et al. 2010). Invasive plant species may find advantages over native species in competition for soils, water, favorable growing locations, pollinators, etc. in a warmer environment. Plant invasions can be enhanced by warmer temperatures, earlier springs and earlier snowmelt, reduced snowpack, and changes in fire regimes (Vose et al. 2012). Sudden oak death is a tree disease caused by the pathogen *Phytophthora ramorum* that afflicts tanoak, coast live oak, and black oak trees in the coastal ranges of northern California and southern Oregon (Kliejunas 2011:21, Garbelotto et al. 2014). A warmer climate is expected to increase areas climatically suitable for the pathogen, and a warmer and wetter climate is estimated to result in a high likelihood of increased disease damage (Kliejunas 2011). Changes in forest vegetation due to invasive plant species may impact the composition and abundance of fisher prey. Although the available evidence indicates that climate change is progressing, its effects on fisher populations are unknown and will likely vary throughout its range in the state.

Regulatory and Listing Status

Federal

The fisher is considered a sensitive species by the USFS and the BLM. A sensitive species is a plant or animal species identified by a Regional Forester for which population viability is a concern based on significant current or predicted downward trends in its numbers, density, or habitat capability that reduce its existing distribution (USDA Forest Service n.d.).

On December 5, 2000, the USFWS received a petition from the Center for Biological Diversity and other groups to add the Distinct Population Segment (DPS) of the fisher that includes portions of California, Oregon, and Washington to the list of endangered species pursuant to the Endangered Species Act, and to concurrently designate critical habitat for this DPS (US Fish and Wildlife Service 2014). On April 8, 2004, the USFWS published a 12-month status review (69 FR 18769) finding that the West Coast DPS of fisher was warranted for listing, but was precluded by higher priority actions and through this finding added the fisher to the federal candidate species list[43]. On October 7, 2014, the USFWS published its proposal to list the West Coast DPS of fisher in California, Oregon, and Washington, as a threatened species (US Fish and Wildlife Service 2014).

State

The fisher is currently designated by the Department as a Species of Special Concern and as a state candidate species.

Generally, a Species of Special Concern is a species, subspecies, or distinct population of an animal native to California that satisfies one or more of the following criteria: 1) is extirpated from the State; 2) is Federally listed as threatened or endangered; 3) has

[43] Federal candidate species are plants and animals for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act (ESA), but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Federal candidate species receive no statutory protection under the ESA.

undergone serious population declines that, if continued or resumed, could qualify it for State listing as threatened or endangered; and/or 4) occurs in small populations at high risk that, if realized, could qualify it for State listing as threatened or endangered. However, “Species of Special Concern” is an administrative designation and carries no formal legal status.

A species becomes a state candidate upon the Fish and Game Commission’s determination that a petition to list the species as threatened or endangered provides sufficient information to indicate that listing may be warranted (Cal. Code Regs., tit. 14, § 670.1, subd. (e)(2)). During the period of candidacy, candidate species are protected as if they were listed as threatened or endangered under the California Endangered Species Act (Fish & G. Code, § 2085).

Existing Management, Monitoring, and Research

Management of Federal Land

Federal land management agencies are guided by regulations and policies that consider the effects of their actions on wildlife. The majority of federal actions must comply with National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. § 4321, et seq.). This Act requires Federal agencies to document, consider, and disclose to the public the impacts of major Federal actions and decisions that may significantly impact the environment.

Substantial federal lands are protected or managed specifically for their wildlife resources or other values. These areas include lands in Wilderness Areas, National Parks, and other land designations where timber harvesting is precluded or constrained. Although some portions of those lands are unlikely to be occupied by fishers due to the habitats they support or the elevations at which they occur, considerable area is predicted to provide habitat of intermediate or high quality for fishers (Tables 6 and 7). Approximately 13,400 km^2 (5,100 mi^2) or 33% of the NC ESU area is composed of Wilderness, National Park, Late Successional Reserve, or other land designations predicted to provide habitat of intermediate or high quality for fishers. In the Southern Sierra Nevada, about 5,550 km^2 (2,140 mi^2) or 71% of the SSN ESU area is designated as Wilderness, National Park, Southern Sierra Fisher Conservation Area, or other land predicted to provide intermediate or high quality habitat for fishers.

U.S. Forest Service: The majority (approximately 55%) of land within the current range of the fisher in California is public and the most of these lands are managed by the USFS. The historical range of fishers described by Grinnell et al. (1937), encompassed all or portions of the Mendocino, Six Rivers, Klamath, Shasta-Trinity, Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, Inyo, Humboldt-Toyiabe, and Sequoia National Forests as well as the Tahoe Basin Management Unit.

The status of the fisher as a sensitive species on USFS and BLM lands in California requires that land management plans adopted by these agencies consider fisher. USFS sensitive species, such as fisher, are plant and animal species identified by the

Table 6. Aerial extent of predicted fisher habitat (low, intermediate, and high) on federal lands where timber harvest is restricted or precluded within the Northern California Fisher Evolutionarily Significant Unit[44]. Fisher habitat values were based on a model of potential habitat quality developed by the Conservation Biology Institute and the US Fish and Wildlife Service.

	Square Kilometers (Square Miles)					
NC ESU	Low	Percent of Total ESU	Intermediate	Percent of Total ESU	High	Percent of Total ESU
Congressionally Reserved	1,916 (740)	4.7%	2,257 (871)	5.5%	1,751 (676)	4.3%
Late Successional Reserves	739 (285)	1.8%	1,476 (570)	3.6%	3,546 (1369)	8.6%
Administratively Withdrawn Lands	287 (111)	0.7%	336 (130)	0.8%	654 (252)	1.6%
Northern Spotted Owl Critical Habitat*	234 (90)	0.6%	1,024 (395)	2.5%	2,389 (922)	5.8%
Total	3,176 (1,226)	7.8%	5,093 (1,966)	12.4%	8,340 (3,220)	20.3%

*Only northern spotted owl critical habitat occurring on federal lands was included because spotted owl critical habitat has no effect on private lands unless there is a federal connection.

[44] Congressionally reserved areas include wilderness and National Parks. Within Late Successional Reserves management actions are permitted to benefit late-successional forest characteristics or to reduce the risk of catastrophic loss. Administratively withdrawn areas represent lands excluded from timber harvesting. Critical habitat designations apply to land at the time a species is listed that has the physical or biological features considered by the US Fish and Wildlife Service to be essential for its conservation and that may require special management.

Table 7. Aerial extent of predicted fisher habitat (low, intermediate, and high) on federal lands where timber harvest is restricted or precluded within the Southern Sierra Fisher Evolutionarily Significant Unit[45]. Fisher habitat values were based on a model of potential habitat quality developed by the Conservation Biology Institute and the US Fish and Wildlife Service.

	Square Kilometers (Square Miles)					
SSN ESU	Low	Percent of Total ESU	Intermediate	Percent of Total ESU	High	Percent of Total ESU
Congressionally Reserved	524 (202)	6.7%	304 (117)	3.9%	1,346 (520)	17.3%
Southern Sierra Fisher Conservation Area	630 (243)	8.1%	321 (124)	4.1%	3,449 (1,332)	44.3%
Old Forest Emphasis Area	2 (1)	0%	16 (6)	0.2%	113 (44)	1.5%
Total	1,156 (446)	14.8%	641 (248)	8.2%	4,908 (1,895)	61.6%

Regional Forester for which population viability is a concern due to a number of factors including declining population trend or diminished habitat capacity. The goal of sensitive species designation is to develop and implement management practices so that these species do not become threatened or endangered. Sensitive species within the USFS Pacific Southwest Region must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for federal listing (USDA FSM 2672.1).

Current USFS policy requires biological evaluations for sensitive species for projects considered by National Forests (USDA FSM 2672.42). Pursuant NEPA, the USFS analyzes the direct, indirect, and cumulative effects of the actions on federally listed, proposed, or sensitive species. The fisher is designated as a sensitive species on 11

[45] Congressionally reserved areas include wilderness and National Parks. The Southern Sierra Fisher Conservation Area encompasses the known occupied range of fishers in the Sierra Nevada. Old Forest Emphasis Areas were established under the Sierra Nevada Forest Plan Amendment and are intended to create forests with structure and function that generally resemble pre-settlement conditions.

National Forests in California: Eldorado, Inyo, Klamath, Mendocino, Plumas, San Bernardino, Shasta-Trinity, Sierra, Six Rivers, Stanislaus, and Tahoe.

Bureau of Land Management: Management of BLM lands is authorized under approved Resource Management Plans prepared in accordance with the Federal Land Policy and Management Act, NEPA, and various other regulations and policies. Some Plans (e.g., Sierra Resource Management Plan) include conservation strategies for fishers and other special status species. The Sierra Resource Management Plan contains objectives to sustain and manage mixed evergreen forest ecosystems to support viable populations of fishers by conserving denning, resting, and foraging habitats (USDI Bureau of Land Management 2008:58). It also contains provisions to manage lands within the plan area to support large trees and snags, to provide habitat connectivity among federal lands, and to make acquisition of fisher habitat a priority when evaluating private lands for purchase (USDI Bureau of Land Management 2008:58, 59).

Management of BLM lands within northern spotted owl range is also subject to provisions of the Northwest Forest Plan. Its mandate is to take an ecosystem approach to managing forests based on science to maintain healthy forests capable of supporting populations of species such as fishers associated with late-successional and old-growth forests (USDA Forest Service and USDI Bureau of Land Management 1994*a*:A–1).

National Park Service: Compared to other public lands which are primarily administered for multiple uses, National Parks are among the most protected lands in the nation (Hannibal 2012). The National Park Service does not classify species as sensitive, but considers special designations by other agencies (e.g., sensitive, species of special concern, candidate, threatened, and endangered) in planning and implementing projects. Forested lands within National Parks are not managed for timber production and salvage logging post-wildfires is limited to the removal of trees for public safety. Fires occurring in parks in the Sierra Nevada are either managed as natural fires or as prescribed burns (Yosemite National Park 2004).

Special Federal Land Designations, Management, and Research

Northwest Forest Plan: In 1994, the Northwest Forest Plan was adopted by the USFS and BLM to guide the management of over 97,000 km^2 (37,500 mi^2) of federal lands in portions of northwestern California, Oregon, and Washington within the range of the

northern spotted owl (USDA Forest Service and USDI Bureau of Land Management 1994*b*:entire). Adoption of the Northwest Forest Plan resulted in amendment of USFS and BLM management plans to include measures to conserve the northern spotted owl and other species, including the fisher, on federal lands.

The Northwest Forest Plan created an extensive network of forest reserves (Figure 24). These Late Successional Reserves, Congressionally Reserved Areas, Administratively Withdrawn Areas, and Riparian Reserves are managed to retain existing natural features or to protect and enhance late-successional and old-growth forest ecosystems. Timber harvesting is permitted under Matrix lands designed in the plan; however, the area available for harvest is constrained to protect sites occupied by marbled murrelets, northern spotted owls, and sites occupied by other species.

Riparian Reserves apply to all land allocations to protect riparian dependent resources. With the exception of silvicultural activities that are consistent with Aquatic Conservation Strategy objectives, timber harvest is not permitted within Riparian Reserves, which can vary in width from 30 to 91 m (100 to 300 feet) on either side of streams, depending on the classification of the stream or waterbody (USDA Forest Service and USDI Bureau of Land Management 1994*a*:C–30, C–31).

Since the Northwest Forest Plan's inception, the total volume of timber harvested by all national forests and BLM districts from 1995 through 2008 has fluctuated. Timber harvest volumes increased for several years following implementation of the plan, then declined substantially as a result of lawsuits, increased from 2001 through 2005, and declined from 2006 through 2008 (Grinspoon and Phillips 2011:7). This plan created a network of late-successional and old-growth forests that currently provide habitat for fishers and can reasonably be expected to continue to do so in the future. Nonetheless, benefits to fisher populations from implementation of the Northwest Forest Plan have not been demonstrated (B. Zielinski, pers. comm.).

Northern Spotted Owl Critical Habitat: In developing its designation of critical habitat for the northern spotted owl, the USFWS recognized the importance of implementing the Northwest Forest Plan to the conservation of native species associated with old-growth and late-successional forests. The designation of critical habitat for the northern

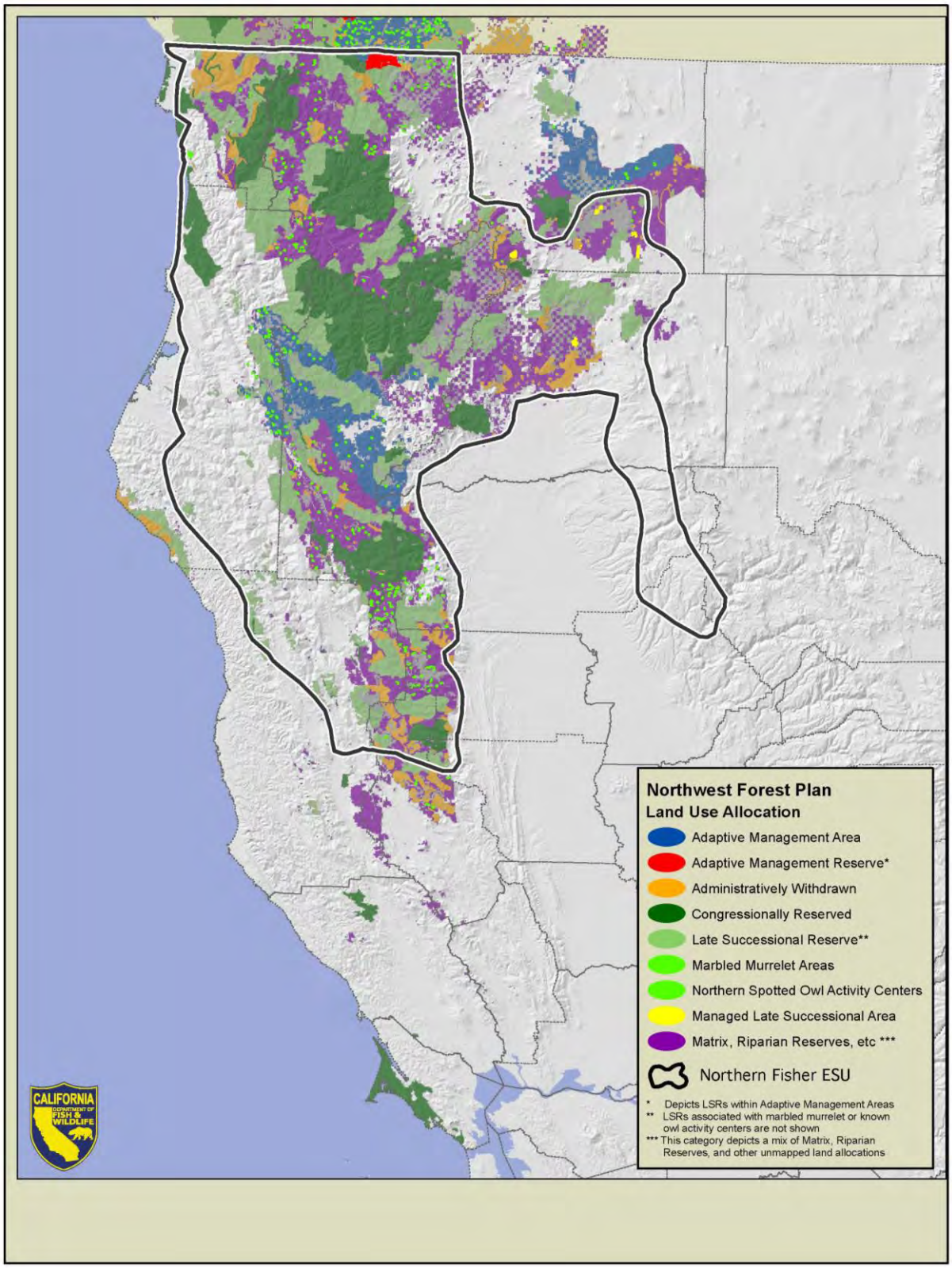

Figure 24. Northwest Forest Plan land use allocations (The Pacific Northwest Interagency Monitoring Program - Northwest Forest Plan Monitoring - Map Data n.d.). California Department of Fish and Wildlife, 2014.

spotted owl did not alter land use allocations or change the Standards and Guidelines for management under the Plan, nor did the rule establish any management plan or prescriptions for the management of critical habitat. Nevertheless, it encourages federal land managers to implement forest management practices recommended in the Revised Recovery Plan for the northern spotted owl. Those practices include conservation of older forest, high-value habitat, areas occupied by northern spotted owls, and active management of forests to restore ecosystem health in many parts of the owl's range. These actions are intended to restore natural ecological processes where they have been disrupted or suppressed. By this rule, the USFWS encourages the conservation of existing high-quality northern spotted owl habitat, restoration of ecosystem health, and implementation of ecological forestry management practices recommended in the Revised Northern Spotted Owl Recovery Plan. Northern spotted owl critical habitat comprises substantial habitat within the range of fishers in northern California (Figure 25).

Sierra Nevada Forest Plan Amendment: The USFS adopted this amendment in 2001 to direct the management of National Forests within the Sierra Nevada. A Supplemental Environmental Impact Statement was subsequently adopted in 2004, to better achieve the goals of the plan amendment by refining management direction for old forest ecosystems and associated species, aquatic ecosystems and associated species, and fire and fuels management (Troyer and Blackwell 2004). The Supplemental Environmental Impact Statement also amended Land Management Plans for National Forests within the Sierra Nevada.

In 2014, the US Forest Service reached a U.S. Ninth Circuit court mediated agreement with the Sierra Forest Legacy in response to a lawsuit (Case No. Civ. S-05-0205 MCE/GGH) challenging the Forest Service's adoption of the 2004 Sierra Nevada Forest Plan Amendment. (*Sierra Forest Legacy v. Bonnie*, ___ F.3d ____, dism. purs. to settlement (9th Cir. 2014). In the subsequent settlement, the USFS agreed not to issue a Draft Environmental Impact Statement for the revised forest plans for the Sierra, Sequoia, and Inyo National Forests until the completion of a conservation strategy for fishers. In addition, the USFS (at its sole discretion) agreed to include and analyze an alternative in its Draft Environmental Impact Statement that is consistent with the findings and recommendations in the fisher conservation strategy. The effectiveness of

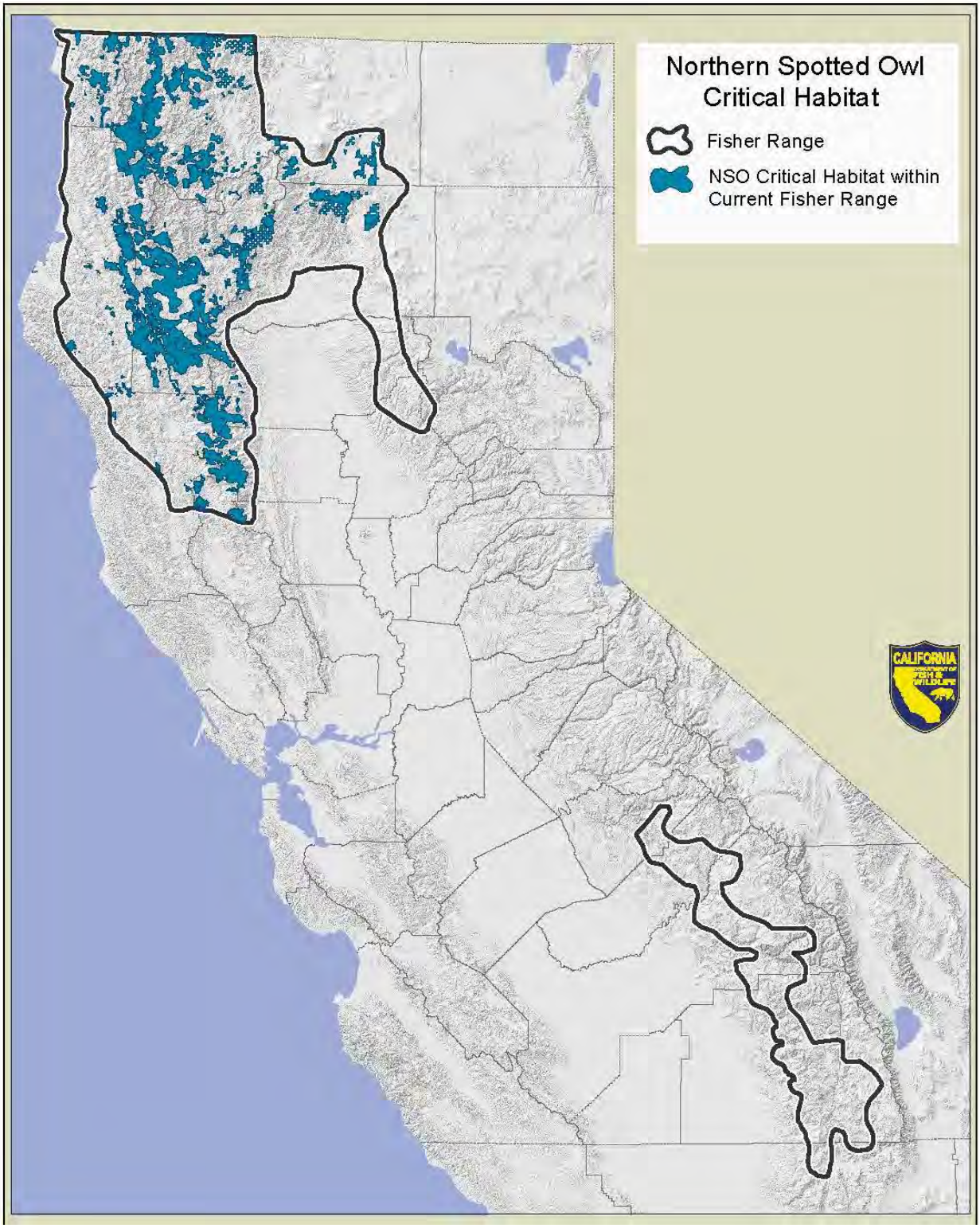

Figure 25. Distribution of northern spotted owl critical habitat within the current estimated range of fishers in California.

the provisions of the Sierra Nevada Forest Plan Amendment with respect to maintaining a viable fisher population in the southern Sierra Nevada has yet to be demonstrated. Nevertheless, some land allocations and specific measures intended to conserve habitat for fishers and other wildlife associated with similar habitats under the amendment are likely to benefit fishers in the southern Sierra Nevada.

The Record of Decision for the Sierra Nevada Forest Plan Amendment contains broad management goals and strategies to address old forest ecosystems, describe desired land allocations across the Sierra Nevada, outline management intents and objectives, and establish management standards and guidelines. Broad goals of the plan amendment's conservation strategy for old forest and associated species are as follows:

- Protect, increase, and perpetuate desired conditions of old forest ecosystems and conserve species associated with these ecosystems while meeting people's needs for commodities and outdoor recreation activities;
- Increase the frequency of large trees, increase structural diversity of vegetation, and improve the continuity and distribution of old forests across the landscape; and

- Restore forest species composition and structure following large scale, stand-replacing disturbance events.

The Sierra Nevada Forest Plan Amendment established a network of land allocations to provide direction to land managers designing fuels and vegetation management projects. A number of these land allocations contain specific measures to conserve habitat for fishers or will likely benefit fishers by conserving habitat for other species or resources. These include land allocations for:

- Wilderness areas and wild and scenic rivers
- California spotted owl protected activity centers
- Northern goshawk protected activity centers
- Great gray owl protected activity centers
- Forest carnivore den site buffers
- California spotted owl home range core areas
- Southern Sierra Fisher Conservation Area

- Old forest emphasis areas
- General forest
- Riparian conservation areas

Wilderness Areas: In California, there are 40 designated Wilderness areas administered by the USFS totaling approximately 19,800 km^2 (7,650 $mi^{2)}$ within the historical range of the fisher described by Grinnell et al. (1937). Within the current range of the fisher, there are 16 wilderness areas encompassed by the northern population totaling approximately 14,160 km^2 (5,470 mi^2) and 10 wilderness areas encompassing the southern Sierra Nevada population totaling about 1,680 km^2 (650 mi^2). Wilderness areas within the historical and current range of fishers in the state are managed by the USFS to preserve their natural conditions; activities are coordinated under the National Wilderness Preservation System. Although many wilderness areas in California include lands at elevations and habitats not typically occupied by fishers, considerable suitable habitat is predicted to occur within their boundaries.

Giant Sequoia National Monument: The 1,328 km^2 (512 mi^2) Giant Sequoia National Monument is located in the southern Sierra Nevada and is administered by the USFS, Sequoia National Forest. Presidential proclamation established the Monument in 2000 for the purpose of protecting specific objects of interest and directed that a Management Plan be developed to provide for those objects' proper care (Giant Sequoia Management Plan, 2012). Fisher, as well as a number of other species such as American marten, great gray owl, northern goshawk, California spotted owl, peregrine falcon, and the California condor were identified as objects to be protected. Habitats within Giant Sequoia National Monument are intended to be managed to support viable populations of these species. Land allocations have been established that include, but are not limited to, designated wilderness, wild and scenic river corridors, the Kings River Special Management Area, and the Sierra Fisher Conservation Area (1,259 km^2 (486 mi^2)). The current Management Plan lists specific objectives to study and adaptively manage fishers and fisher habitat and a strategy to protect high quality fisher habitat from any adverse effects of management activities.

Sierra Nevada Adaptive Management Project: This project was initiated in 2005 by the USFS who assembled researchers from the University of California to evaluate the impacts of fuel thinning treatments designed to reduce the hazard of fire on wildlife,

watersheds, and forest health (Sulak and Huntsinger 2012:313). A primary intent was to test adaptive management processes through testing the efficacy of Strategically Placed Landscape Treatments and focused on four response variables, including fishers. As of March 2014, a total of 113 fishers (48 males and 65 females) have been captured and radio-collared as part of this investigation (Smith 2014).

Kings River Fisher Project: The Pacific Southwest Research Station initiated the Kings River Fisher Project in 2007 in response to concerns about the effects of fuel reduction efforts on fishers in the southern Sierra Nevada (Kings River Fisher Project | Mammals | Wildlife & Fish | Research Topics n.d.). The project area encompasses about 532 km^2 (205 mi^2) and is located southeast of Shaver Lake on the Sierra National Forest. The primary objectives of the study include better understanding fisher ecology and addressing uncertainty surrounding the effects of timber harvest and fuels treatments on fishers and their habitat. Over 100 fishers have been captured and radio collared, 153 dens were located, and more than 500 resting structures have been identified (Kings River Fisher Project | Mammals | Wildlife & Fish | Research Topics n.d.). Predation has been the primary cause of death of the fishers studied.

State Land

State lands comprise only about 1% of fisher range in California. State agencies are subject to the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). CEQA requires that projects on state lands that may result in significant and adverse impacts to fishers be mitigated, if feasible. Recreation is diverse and widespread on state lands but, as is the case with federal lands, the impacts of public use of state lands on fishers are expected to be low. Public use may result in temporary disturbance to individual fishers, but the adverse impacts are unlikely due to the small area involved and relatively low level of public use of dense forested habitat. Some state lands are harvested for timber. Commercial harvest of timber on state lands is regulated under the California Forest Practice Rules (Cal. Code Regs., tit. 14, Chapters 4, 4.5, and 10, hereafter generally referred to as the Forest Practice Rules) that require the preparation and approval of Timber Harvesting Plans prior to harvesting trees on California timberlands.

Private Timberland

The Department estimates that approximately 39% of current fisher range in California is composed of private or State lands regulated under the Z'berg-Nejedly Forest Practice Act (Pub. Resources Code, §4511 et seq.) and associated Forest Practice Rules promulgated by the State Board of Forestry and Fire Protection. The purpose of the Forest Practice Rules is to implement provisions of the Act in a manner that is consistent with other laws, including the California Environmental Quality Act (CCR, Title 14, § 896(a)).

The Forest Practice Rules are enforced by CAL FIRE and are the primary set of regulations for commercial timber harvesting on private and State lands in California. Timber harvest plans prepared by Registered Professional Foresters provide: (1) information the CAL FIRE Director needs to determine if the proposed timber operation conforms to State Board's rules; and (2) information and direction to timber operators so they comply with State Board's rules (Cal. Code Regs., tit. 14, § 1034). The preparation and approval of timber harvest plans is intended to ensure that impacts from proposed operations that are potentially significant to the environment are considered and, when feasible, mitigated.

The Forest Practice Rules promulgated under the Act specify that an objective of forest management is the maintenance of functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within planning watersheds. This language may result in actions on private lands beneficial to fishers. (Cal. Code Regs., tit. 14, § 897, subd. (b)(1)(B). The information about what constitutes the "existing wildlife community" is frequently lacking in timber harvest plans, and specific guidelines to retain habitat for fishers are not provided in the Forest Practice Rules.

Although the Forest Practice Rules do not require measures specifically designed to protect fishers, the Rules do provide for the retention of habitat and habitat elements important to the species. Trees potentially suitable for denning or resting by fishers may be voluntarily retained by the applicant in order to achieve post-harvest stocking requirements under the Forest Practice Rules subsection relating to "decadent or deformed trees of value to wildlife" (Cal. Code Regs., tit. 14, §§ 912.7, subd. (b)(3), 932.7, subd. (b)(3), 952.7, subd. (b)(3)). Although habitat and habitat elements suitable for fishers may be voluntarily retained under those provisions of the Forest Practice

Rules, they are optional and how frequently this occurs and the benefit to fishers has not been demonstrated. The intervals between harvests on commercial timberlands are typically too short to allow structures in trees of sufficient size to develop and function as suitable den or rest sites, without specific provisions to protect and provide for their long-term recruitment through harvest rotations.

Additional habitat suitable for fishers may be retained within Watercourse and Lake Protection Zones (Cal. Code Regs., tit. 14, § 916 et seq.). Watercourse and Lake Protection Zones are defined areas along streams where the Forest Practice Rules restrict timber harvest in order to protect instream habitat quality for fish and other resources. Harvest restrictions and retention standards differ across the range of the fisher, but these zones may encompass 15 m - 45 m (50-150 ft) on each side of a watercourse, 30m - 91 m (100-300 ft) in total width depending on side slope, location in the state, and the watercourse's classification. Generally, within Watercourse and Lake Protection Zones, at least 50% of the tree overstory and 50% of the understory canopy covering the ground and adjacent waters must be retained in a well distributed multi-storied stand composed of a diversity of species similar to that found before the start of timber operations. The residual overstory canopy must be composed of at least 25% of the existing overstory conifers and at least two living conifers per acre must be retained that are at least 40.6 cm (16 in) in dbh and 15.2 m (50 ft) tall within 15.2 m (50 ft) of streams that support fish or non-fish aquatic species. In some locations, Watercourse and Lake Protection Zones constitute 15% or more of a watershed, but this will vary depending on the types of watercourses present and their density within harvested areas (J. Croteau, pers. comm.).

Where Watercourse and Lake Protection Zones allow large trees with cavities and other den structures to develop, they may provide fishers a network of older forest structure within managed forest landscapes. For watersheds that fall within Anadromous Salmonid Protection rules (Cal. Code Regs., tit. 14, §§ 916.9, 936.9, 956.9), the 13 largest trees/acre (live or dead) must be retained. The Anadromous Salmonid Protection Rules are similar to the provisions of Green Diamond Resource Company's Aquatic Habitat Conservation Plan. On its lands in northwestern California, riparian areas can represent from less than 5% to more than 50% of a timber harvest unit based on data from high resolution aerial photographs taken immediately post-harvest (M. House, pers. comm.). The proportion of harvest areas encompassed by these zones is

partly a function of stream density and the classification of watercourses present. Over time, implementation of these rules will likely promote the development of trees of sufficient size and structure suitable for use by fishers for resting and denning (J. Croteau, pers. comm.), however, many early season dens occur upslope of Watercourse and Lake Protection Zones (S. Matthews, pers. comm.).

For ownerships encompassing at least 20,234 ha (50,000 ac), the Forest Practice Rules require a balance between timber growth and yield over 100-year planning periods. Sustained Yield Plans and Option A plans (Cal. Code Regs., tit. 14, §§ 1091.1, 913.11, 933.11, 959.11) are two options for landowners with large holdings that meet this requirement. Consideration of other resource values, including wildlife, is also given in these plans, which are reviewed by specific review team agencies and the public and approved by CAL FIRE. Implementation of either option may provide forested habitat that is suitable for fishers. Nevertheless, the plans are inherently flexible, making their long-term effectiveness in providing functional habitat for fishers uncertain.

Landowners harvesting dead, dying, and diseased conifers and hardwood trees may file for an exemption from the FPR's requirements to prepare timber harvest plans and stocking reports (CCR, Title 14, § 1038(b)). Timber harvesting under exemptions is limited to removal of 10% or less of the average volume per acre. Exemptions may be submitted by ownerships of any size and can be filed annually. The Forest Practice Rules impose a number of restrictions related to exemptions including generally prohibiting the harvest of old trees [trees that existed before 1800 AD and are greater than 152.4 cm (60 in) at the stump for Sierra or Coastal Redwoods and trees; greater than 121.9 cm (48 in) for all other species]. Exceptions to this rule are provided under CCR, Title 14, § 1038(h).

Landowners harvesting dead, dying, and diseased conifers and hardwood trees may file for an exemption from the FPR's requirements to prepare timber harvest plans and stocking reports (Cal. Code Regs., tit. 14, § 1038, subd. (b)). Timber harvesting under such exemptions is limited to removal of 10% or less of the average volume per acre. Exemptions may be submitted by ownerships of any size and can be filed annually. The Forest Practice Rules impose a number of restrictions related to exemptions, including generally prohibiting the harvest of old trees (trees that existed before 1800 AD and are greater than 152.4 cm (60 in) at the stump for Sierra or Coastal Redwoods

and trees; greater than 121.9 cm (48 in) for all other species). Exceptions to this rule are provided in Forest Practice Rules Section 1038(h).

Portions of the Forest Practice Rules (Cal. Code Regs., tit. 14, §§ 895.1, 919.16, 939.16, 959.16) relate to late succession forest stands on private lands. Proposals to harvest such areas are infrequent, probably because few stands on private lands meet the criteria for consideration under the rules[46] (pers. comm., C. Babcock, CDFW). When a late succession stand is proposed for harvest, the Department generally provides recommendations designed to mitigate any potential significant adverse impacts to wildlife. These recommendations are often tied to species such as the fisher and generally involve the retention of late seral stand characteristics (e.g., tree sizes, canopy layers, stand size) and habitat elements (e.g., conifers/hardwoods with cavities or other structures) or changes to proposed silvicultural methods. These measures are incorporated into the harvesting plan at the discretion of CAL FIRE. Where it has been determined that proposed operations will result in significant adverse impacts to fish, wildlife, and listed species associated primarily with late successional forests, feasible measures to mitigate or avoid those effects must be implemented. If it is determined that significant impacts cannot be effectively minimized or avoided, the lead agency (i.e., CAL FIRE), has the authority to deny the timber harvesting plan or approve it based on overriding considerations.

Private timberland owners are not specifically required to retain or recruit hardwoods and, in some cases, their harvest may be required by regulation to meet stocking standards. Hardwoods may also be intentionally killed individually or in clusters to recruit conifers. Throughout much of the occupied range of fishers in California, hardwoods appear to be an important element of their habitats. Some hardwood species provide potential den and rest trees and habitat used by fisher prey. On private timberlands, existing regulations also require the retention of snags unless they are considered merchantable or pose a safety, fire, insect, or disease hazard. However,

[46] Under the Forest Practice Rules, late succession forest stands are stands of dominant and predominant trees that meet the criteria of WHR class 5M, 5D, or 6 with an open, moderate or dense canopy closure classification, often with multiple canopy layers, and are at least 8 ha (20 ac) in size. Functional characteristics of late succession forests include large decadent trees, snags, and large down logs (Cal. Code Regs, tit. 14, § 895.1).

live trees of various species as well as merchantable snags are not required to be retained, even if potentially used as den or rest sites and there is no specific requirement to recruit snags.

Some timberland owners (industrial and non-industrial) have instituted voluntary management policies and/or developed management plans that may contribute to conservation of fishers and their habitat. These measures may include the retention of snags, green trees (including trees with structures of value to wildlife), hardwoods, and downed logs. The retention of forest structure is often valuable to many species of wildlife and fishers have been documented using rest and den structures which were voluntarily retained by landowners within timber harvest units. However, the Department is unaware of any analysis of the effects of these voluntary actions on fisher populations.

Private Timberland – Conservation, Management, and Research

Forest Stewardship Council Certification: In 1993, the Forest Stewardship Council was formed to create a voluntary, market-based approach to improve forest practices worldwide (FSC Forest Stewardship Council U.S. (FSC-US) · Our History n.d.). The Council's mission is to promote environmentally sound, socially beneficial, and economically prosperous forest management founded on a number of principles including the conservation of biological diversity, maintenance of ecological functions, and forest integrity (FSC Forest Stewardship Council U.S. · Mission and Vision n.d.). In California, approximately 6,475 km^2 (2500 mi^2) of forest lands have been certified by the Forest Stewardship Council (preview.fsc-certified-acres-by-state.a-204.pdf n.d.). Although this certification requires participants to retain habitat elements of value to fishers, the effects of these practices on fisher populations have not been studied.

Habitat Conservation Plans: Habitat Conservation Plans authorize non-federal entities to "take," as that term is defined in the federal Endangered Species Act (16 U.S.C., § 1531 *et seq*.), threatened and endangered species. Applicants for incidental take permits under Section 10 of the Endangered Species Act must submit Habitat Conservation Plans that specify, among other things, impacts that are likely to result from the taking and measures to minimize and mitigate those impacts. A Habitat Conservation Plan may include conservation measures for candidate species, proposed species, and other species not yet listed under the Endangered Species Act at the time

the project is developed or a permit application is submitted. This process is intended to ensure that the effects of the incidental take that may be authorized will be adequately minimized and mitigated to the maximum extent practicable. There are six Habitat Conservation Plans in California within the range of the fisher (Table 8). Of those, only the Humboldt Redwoods plan specifically addresses fishers, although other plans contain provisions such as retention of late seral habitat elements intended to benefit species such as the northern spotted owl (e.g., Green Diamond Resources Company) should also benefit fishers. The Green Diamond aquatic Habitat Conservation Plan also has provisions that over the next 50 years will set aside approximately 40,460 ha (100,000 ac) of riparian and geologic reserves that should develop late seral elements beneficial to fishers.

Fisher Translocation: A primary conservation concern for fishers has been the reduction in overall distribution in the state. Fishers have been successfully translocated many times to reestablish populations in North America (Lewis et al. 2012), and reestablishing a population in formerly occupied range was believed to be an important step towards strengthening the statewide population in California (Callas and Figura 2008).

From late 2009 through late 2011, the Department translocated[47] individual fishers from northwestern California to private timberlands in Butte County owned by Sierra Pacific Industries. This effort, the first of its kind in California, was undertaken in cooperation with Sierra Pacific Industries, USFWS, and North Carolina State University. Prior to translocating fishers to the northern Sierra Nevada, the Department assessed the suitability of five areas as possible release sites (Callas and Figura 2008). Those lands represented most of the large, relatively contiguous tracts of Sierra Pacific Industries' property within the southern Cascades and northern Sierra Nevada. The Department considered a variety of factors in its evaluation of the feasibility of translocating fishers onto Sierra Pacific Industries' property, including habitat suitability of candidate release sites, prey availability, genetics, impacts to other special status species, disease, predation, and the effects of removing animals on donor populations.

[47] Translocation refers to the human-mediated movement of living organisms from one area for release in another area (IUCN and SSC 2013:1).

Table 8. Approved Habitat Conservation Plans (HCPs) within the range of the fisher in California.

HCP Name	Location	Area	Permit Period	Covered Species
Green Diamond Resources Company	Del Norte & Humboldt counties	1,647 km^2 /636 mi^2	1992-2022 (30 years)	• northern spotted owl
Humboldt Redwood Company (PALCO)	Humboldt County	854 km^2 /330 mi^2	1999-2049 (50 years)	• American peregrine falcon • marbled murrelet • northern spotted owl • bald eagle • western snowy plover • bank swallow • red tree vole • pacific fisher • foothill yellow-legged frog • southern torrent salamander • northwestern pond turtle • northern red-legged frog
Green Diamond Resources Company	Humboldt and Del Norte counties	1,688 km^2 /652 mi^2	2007-2057 (50 years)	• chinook salmon (California Coastal, Southern Oregon and Northern California Coastal, and Upper Klamath/Trinity Rivers ESUs) • coho salmon (Southern Oregon/Northern California Coast ESU) • steelhead (Northern California DPS, Klamath Mountains Province ESU). • resident rainbow trout • coastal cutthroat trout • tailed frog • southern torrent salamander

From late 2009 through late 2011, 40 fishers (24 female, 16 male) were released onto the Stirling Management Area. All released fishers were equipped with radio-transmitters to allow monitoring of their survival, reproduction, dispersal, and home range establishment. The released fishers experienced high survival rates during both the initial post-release period (4 months) and for up to 2 years after release (Powell et al. 2013). A total of 11 of the fishers released onto Stirling died by the spring of 2013. Twelve female fishers known to have denned at Stirling produced a minimum of 31 young (Powell et al. 2013).

In October of 2012, field personnel conducted a large scale trapping effort on Stirling to recapture previously released fishers and their progeny. Twenty-nine fishers were captured and, of those, 19 had been born on Stirling (Powell et al. 2013). On average, female fishers recaptured during this trapping effort had increased in weight by 0.1 kg and males had increased in weight by 0.4 kg. Juvenile fishers captured on Stirling weighed more than juveniles of similar age from other parts of California (Powell et al. 2013). Based on the results of trapping at Stirling, to the extent that those captured are representative of the population, most females (70%) were less than 2 years of age and males in that age group represented 47% of the population, suggesting relatively high levels of reproduction and recruitment (Powell et al. 2013).

Candidate Conservation Agreement with Assurances: A "Candidate Conservation Agreement with Assurances for Fisher" between the USFWS and Sierra Pacific Industries regarding translocation of fishers to a portion of Sierra Pacific Industries' lands in the northern Sierra Nevada was approved on May 15, 2008. A Candidate Conservation Agreement with Assurances is intended to enhance the future survival of a federal candidate species, and in this instance provides incidental take authorization to Sierra Pacific Industries should USFWS eventually list fishers under the federal Endangered Species Act. This 20-year permit covers timber management activities on Sierra Pacific Industries' Stirling Management Area, an approximately 65,000 ha (160,000 ac) tract of second-growth forest in the Sierra Nevada foothills of Butte, Tehama, and Plumas counties. This tract is in the northern portion of the gap in the fisher distribution and was believed to be unoccupied by fishers prior to the translocation.

Tribal Lands

Hoopa Valley Tribe: The Hoopa Valley Tribe has been active in fisher research, focusing on den site characteristics, juvenile dispersal, and fisher demography, for nearly 2 decades. The tribal lands are in a unique location near the northwestern edge of the Klamath Province. The fisher is culturally significant to the Hoopa (Hupa) people, and forest management activities are conducted with sensitivity to potential impacts to fishers. Since 2004, the Hoopa Valley Tribe has collaborated with the Wildlife Conservation Society and Integral Ecology Research Center to study the ecology of fishers. One hundred and ten fishers (39 male, 71 female) were monitored with radio telemetry from December 2004 to March 2013 and demographic monitoring continues.

Information gained from fisher research conducted at Hoopa has contributed significantly to the understanding of the species in California. Predation has been the leading cause of mortality for females and toxicosis, primarily from second generation anticoagulant rodenticides, has been the leading cause of mortality for males (Higley et al. 2013).

Tule River Tribe: The Tule River Tribe is located in southeastern Tulare County in the southern Sierra Nevada. The tribe manages approximately 22,400 ha (55,000 ac) (Baker and Stewart 1996:1357). This region supports black oak and ponderosa pine at elevations between approximately 1,200 m - 1,500 m (4,000-5,000 ft), mixed conifer forest to 2,100 m (7,000 ft), and true fir forests at higher elevations on north-facing slopes (Rueger 1992:116). Resource management on the reservation is governed by the Tribal Council (Rueger 1992:116) and exemplifies a multiple use philosophy which balances commodity and non-commodity resources values (Baker and Stewart 1996:1358). Some habitats managed by the Tule River tribe are occupied by fishers and the tribe has cooperated with research comparing marten and fisher home range and habitat characteristics, diet, and interspecific competition (Spencer et al. 2015:3).

Fisher Working Groups

California Fisher Working Group: The primary goal of this group is to share current information about fishers and foster collaboration, with the goal of maintaining healthy, viable fisher populations in California. The focus of the California Fisher Working Group is on recent research and conservation matters related to fishers. Meetings are held annually in conjunction with the Western Section of the Wildlife Society Conference and are well attended. At these meetings, short presentations are made by fisher researchers and most presentations are available online.

Southern Sierra Nevada Fisher Working Group: The mission of this group is to provide a forum for wildlife biologists, scientists, and managers to identify, review, develop and communicate research, management, and conservation information and recommendations that promote the long-term viability of fishers in the southern Sierra Nevada. Members agree to work cooperatively to achieve the working group's goals and objectives. The goals include: 1) sharing fisher ecological and management information, 2) identifying, promoting, prioritizing, reviewing, and sharing fisher

ecological and management research needs, 3) providing technical assistance to managers and policy makers, and 4) developing collaborative relationships that promote the long-term viability of fishers in the southern Sierra Nevada. Several subgroups of this working group have been formed to focus on specific tasks. These subgroups are working on issues such as rodenticides, porcupines, and wildlife vehicle collisions. Probably the most important role of the working group recently has been its involvement in the development of the Southern Sierra Nevada Fisher Conservation Assessment (Spencer et al. 2015). Ultimately, this working group will develop a Conservation Strategy for fishers in the southern Sierra Nevada.

Scientific Determinations Regarding the Status of the Fisher in California

The California Endangered Species Act directs the Department to prepare this report regarding the status of the fisher in California based upon scientific and other information available to the Department. (Fish & G. Code, § 2074.6, subd. (a); Cal. Code Regs., tit. 14, § 670.1, subd. (f).) CESA's implementing regulations identify key factors that are relevant to the Department's analyses. Specifically, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).

The definitions of endangered and threatened species in the Fish and Game Code guide the Department's scientific determination. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062). A threatened species under CESA is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts required by [CESA]." (*Id.*, § 2067).

Fishers in California occur in two separate and isolated populations that differ geographically and genetically. Due in part to the distance separating these populations and differences in habitat, climate, and stressors potentially affecting them, the Department has considered them as independent Evolutionarily Significant Units (ESUs) where appropriate in its analysis of listing factors.

The preceding sections of this Status Review report describe the scientific and other information available to the Department, with respect to the key factors identified in the regulations.

Present or Threatened Modification or Destruction of Fisher Habitat

Considerable research has been conducted to understand the habitat associations of the fisher throughout its range. Studies during the past 20 years indicate fishers are found in a variety of low- and mid-elevation forest types. Perhaps the most consistent, and generalizable attribute of home ranges used by fishers is that they are composed of a mosaic of forest plant communities and seral stages, often including relatively high proportions of mid- to late-seral forests.

Landscapes supporting mid- to late-seral forests are suitable for fishers if they contain adequate canopy cover, den and rest structures of sufficient size and number, vertical and horizontal escape cover, and prey. Activities such as timber harvesting, human development, treatment of vegetative fuels in forest, and wildfire can render areas unsuitable for fishers. The demand for and uses of forest products have increased over time and some trees historically considered unmerchantable and left on forest lands when the majority of old-growth timber was logged are merchantable in today's markets. Trees used for denning, in particular, may take decades to reach adequate size, for stress factors to weaken its vigor, and for heartwood decay to advance sufficiently to form a suitable cavity.

Existing regulatory mechanisms on public and private lands in California, established to protect wildlife and wildlife habitat, vary with respect to their potential effectiveness at maintaining or recruiting habitat for fishers. In some cases statutes, regulations, and policies are specifically aimed to benefit fishers or may be designed for other species with similar habitat requirements. The viability of fishers in California will depend, in part, on the retention and recruitment of habitat elements for denning, resting, and the maintenance of sufficient prey populations in habitats where they can be successfully captured by fishers. Thresholds for these attributes of fisher habitat are not well understood and further research is needed to understand how forest structure and the distribution and abundance of micro-structures used for denning and resting affect fisher populations.

NC ESU: Within the NC ESU, large areas supporting habitat suitable for fishers are under federal management or are privately owned and managed for timber production. The majority of the land area in the ESU is administered by the USFS (52%) or in

private ownership (42%). Of the federal properties within this ESU, about 20% or 13,400 km^2 (5,170 mi^2) are specially designated lands predicted to be of intermediate or high value to fishers where timber harvest is restricted or precluded. The treatment of forest fuels to reduce the risk of catastrophic wildfire may decrease habitat suitability for fishers, but overall the benefits of such actions to fishers appear to outweigh the risks, provided that area treated annually is relatively small. Fishers are widespread and common inhabitants of public and private forested landscapes within the NC ESU. The likelihood that forest management activities will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low.

Fire suppression and wildfire have influenced the character and suitability of forests occupied by fishers in the NC ESU. Should fires increase in size and intensity throughout mountainous areas of northern California, they will likely decrease the suitability of some habitats for fishers. Fishers long inhabited California landscapes that were influenced by wildfire in ways that differ substantially from modern and likely future fire regimes and there is uncertainty regarding the future effects of fire and fire suppression on fishers. Within the NC ESU, fishers occur over a relatively large area and are common. The likelihood that wildfire will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low.

Currently human development of fisher habitat within the NC ESU represents a relatively small proportion of the NC ESU and is not predicted to increase substantially in the future. By 2030, approximately 4% of the total area of the ESU is projected to be developed on parcels less than 16.2 ha (40 ac) in size. The likelihood that the alteration or loss of habitat will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low.

SSN ESU: Within the SN ESU, the majority (86%) of the land area is administered by the USFS or the National Park Service and approximately 10% is privately owned. Of the federal properties within this ESU, about 70% or 5,550 km^2 (2,143 mi^2) are predicted to be of intermediate or high value to fishers and represent designated lands where timber harvest is restricted or precluded. The treatment of forest fuels designed to reduce the risk of catastrophic wildfire may result in some decrease in habitat suitability for fishers, but overall the benefits of such actions to fishers appear to outweigh the risks, provided that area treated annually is relatively small. The likelihood that forest

management activities, including fuels treatments, will threaten the continued existence of fishers within the SSN ESU in the foreseeable future is low.

Fire suppression and wildfire have strongly influenced the composition and suitability of forests occupied by fishers in the SSN ESU. Some models of wildfire predict fires of increased size in the future, with the greatest increases occurring within mid-elevations sites on the west slope of the Sierra Nevada. Despite the occurrence of some large, high intensity fires in the southern Sierra Nevada in recent years, wildfires in the region are generally heavily suppressed. Although fuels treatments and fire suppression will likely reduce the size and severity of wildfires in areas occupied by fishers, the effectiveness of these measures in the future is uncertain. The fisher population in the southern Sierra Nevada is vulnerable to habitat loss and fragmentation due to catastrophic fire because of its small size, relatively small geographic area occupied, and the narrow and linear configuration of occupied habitat in the region. Fishers, however, have apparently occupied portions of the southern Sierra Nevada for many centuries, including areas with an extensive history of fire. The likelihood that wildfire will threaten the continued existence of fishers within the SSN ESU in the foreseeable future is moderate.

Currently human development of fisher habitat within the SSN ESU represents a relatively small proportion of the ESU and this is not predicted to increase substantially in the future. By 2030, approximately 5% of the total area of the SSN ESU is projected to be developed on parcels less than 16.2 ha (40 ac) in size. Development predicted to occur in the vicinity of Shaver Lake in the southern Sierra Nevada by 2030, could adversely affect fishers if it creates a barrier to their dispersal and fragments the fisher population in this region. The effect this may have on fishers is unknown and will be influenced by the extent of the development and whether habitat remaining on parcels will function as an effective corridor for fisher movement. The likelihood that human development will threaten the continued existence of fishers within the SSN ESU in the foreseeable future is low.

Overexploitation

Based on the prohibition against commercial or recreational take of fishers, the low level of commercial and recreational trapping and the prohibition of body-gripping traps, the

likelihood that overexploitation will threaten the continued existence of fishers within the NC ESU or the SSN ESU in the foreseeable future is low.

Predation

Predation appears to be the most frequent cause of mortality for fishers in California. This result is not unexpected as the forested landscapes inhabited by fishers are also inhabited by a diverse suite of larger, generalist predators (i.e., bobcats, coyotes, and mountain lions).

NC ESU: Fishers remain well-distributed and readily detectable throughout much of the NC ESU, and there is no evidence that the population is currently declining. The likelihood that predation will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low.

SSN ESU: Studies in the southern Sierra Nevada indicate that predation is the leading cause of death for fishers and currently has a greater effect on population growth in the region than disease, injury, toxicants, and vehicle strikes combined. The Department's concern regarding the vulnerability of the fisher in the southern Sierra Nevada from predation and other sources of mortality is heightened by the population's small size and relatively small geographic area occupied. Nevertheless, fishers have likely been isolated within the region for at least 50 years and appear to have expanded their range in recent decades. The likelihood that predation will threaten the continued existence of fishers within the SSN ESU in the foreseeable future is low.

Competition

Throughout their range in California, fishers compete with a variety of other carnivores including coyotes, foxes, bobcats, American martens, and weasels for food and access to other resources. All of these species use habitats occupied by fishers. Although landscape level habitat changes that favor potential competitors may intensify interspecific competition in some areas, the likelihood that competition will threaten the continued existence of fishers within the NC ESU or the SSN ESU in the foreseeable future is low.

Disease

Considerable research into the health of fisher populations in California has been conducted in recent years and fishers are known to die from a number of infectious diseases that appear to cycle within fisher populations or due to exposure from other species of carnivores. Although a number of viral, bacterial, and parasitic diseases are known to cause morbidity and mortality in fishers and may have been responsible for local population declines, there are no studies indicating that disease is significantly limiting fisher populations in California. The likelihood that disease will threaten the continued existence of fishers within the NC ESU or the SSN ESU in the foreseeable future is low.

Other natural occurrences or human-related activities

Population Size and Isolation: The distribution and abundance of fishers in California appears to have changed substantially before and after Euro-American settlement. Although its precise distribution and population size prior to the 1800s is unknown, recent genetic evidence indicates the fisher population declined dramatically and contracted into two separate populations at some point long before that time. Further reductions in range and abundance likely occurred after Euro-American settlement due to trapping, predator control, and habitat changes that rendered areas unsuitable, or less suitable, for fishers. At present, and perhaps resulting primarily from the 1946 prohibition on fisher trapping and the 1998 ban on body-gripping traps, the number of fishers in California appears to be greater than it was during the mid-1800s to early 1900s.

NC ESU: Within the NC ESU, fishers are distributed over a large geographic area and are common. Currently, the fisher population is likely substantially larger than it was at the time commercial trapping of fishers was banned nearly 70 years ago. In recent decades, detections of fishers have increased in coastal portions of Del Norte and Humboldt counties, in Mendocino County, and in southeastern Shasta County. A small population of fishers has also been established in the northern Sierra Nevada and southern Cascades in Butte County and those animals or their progeny have been documented in eastern Shasta, Tehama, and western Plumas counties. Fishers within the NC ESU are also largely isolated, although their population is contiguous with a small population in southern Oregon. The likelihood that population size and isolation

will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low.

SSN ESU: The fishers population within the SSN ESU is at risk of decline due to its small size (probably less than 300 adults (Spencer et al. 2015:7), limited geographic range, narrow habitat configuration, and apparent low likelihood that it will expand its range further in the near-term without active management. Furthermore, a recent study at the Sierra Nevada Adaptive Management Project study area estimated the population to be declining slightly (rate of growth 0.97, range 0.79-1.16). Small, isolated populations are at risk of extinction from stochastic (random) environmental or demographic events or the loss of genetic diversity, including inbreeding depression. Events such as drought, high intensity fires, and disease, should they occur, could adversely affect the fisher population in the southern Sierra Nevada due to its small population size and limited geographic area.

The fisher population within the SSN ESU is likely to remain small and occur in a limited geographic area in the foreseeable future due to its inability to rapidly disperse to new suitable habitat; the nearest currently known fishers are found in the northern Sierra Nevada near Stirling City, a distance of approximately 285 km (177 mi). However, fishers within the SSN ESU have occurred in small numbers in a relatively small geographic area for decades and, in recent years, its distribution appears to have expanded. The likelihood that population size and isolation will threaten the continued existence of fishers within the SSN ESU in the foreseeable future is moderate.

Toxicants: Fishers in California exhibit high rates of exposure to anticoagulant rodenticides and exposure to other toxicants. Illegal marijuana cultivation sites appear to be the primary source of toxicants detected in fishers, and fishers are exposed either directly by consuming tainted baits or secondarily by consuming poisoned prey. Recent regulation changes for rodenticide use in California will likely influence the types and amounts of rodenticides used at illegal marijuana cultivation sites. Rodenticides and other toxicants may kill fishers directly or indirectly by increasing susceptibility to other mortality factors such as disease, predation, and vehicle strikes. However, the actual contributions of the sublethal effects of toxicants to such mortalities remain unclear.

NC ESU: Fishers are exposed to anticoagulant rodenticides within the NC ESU. Although few deaths from exposure to rodenticides and other toxicants have been confirmed, the likelihood of discovering these events is extremely low. Thus, the confirmed deaths represent a portion of actual toxicant-caused fisher mortalities. While toxicant use at marijuana grow sites has been ongoing for at least a decade, recent trends (i.e., since 2010) in their use are unknown. Future trends are difficult to predict, and depend on the future legal status of marijuana, cultivation practices of growers, and location of grow sites. Fishers remain widely distributed and are common within the NC ESU, suggesting that substantial broad-scale population level impacts due to exposure to rodenticides or other toxicants have not occurred. The likelihood that the illegal use of rodenticides or other toxicants will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low.

SSN ESU: High rates of exposure to anticoagulant rodenticides have been documented within the SSN ESU. Although one study within the ESU associated higher survival of female fishers with home ranges containing fewer grow sites, population level effects have not been demonstrated nor appear likely based on other studies of occupancy, survival, and the causes of fisher mortality in the region.
At the Sierra Nevada Adaptive Management Project site, the direct effect of toxicant poisoning of fishers is small compared to other sources of mortality. Predation removed substantially more fishers from the population in that study than died as result of rodenticide poisoning. The potential growth rate of this population was predicted to increase slightly (1%) in the absence of all deaths from disease, injury, anticoagulant rodenticides, and vehicle strikes. At the Kings River Fisher Project site, none of the known-cause fisher mortalities have resulted from toxicants. The likelihood that the illegal use of rodenticides or other toxicants will threaten the continued existence of fishers within the SSN ESU in the foreseeable future is low.

Climate Change

Climate research predicts continued climate change through 2100, at rates faster than occurred during the previous century. These changes are not expected to be uniform, and considerable uncertainty exists regarding the location, extent, and types of changes that may occur within the range of the fisher in California. Overall, warmer temperatures are expected across the range of fishers in the state, with warmer winters, earlier warming in the spring, and warmer summers.

Projected climatic trends will likely create drier forest conditions, increase fire frequency, and cause shifts in the composition of plant and animal communities (likely including fisher prey species). The effect of warming temperatures on mountain ecosystems will most likely be complex and predicting effects in particular areas is difficult. While evidence demonstrates that climate change is progressing, its effects on fisher populations are unknown, will likely vary throughout the range of fishers in the state, and their severity will likely depend on the extent and speed with which warming occurs. Fishers are already experiencing the effects of climate change as temperatures have increased during the last century.

NC ESU: The fisher population within the NC ESU is currently common and widely distributed across its range, increasing the probability that should some of the predicted effects of climate change be realized, areas of suitable habitat will remain. Some climate models predict a decrease in conifer forest cover exemplified by an increase in mixed forest and mixed woodland cover. Fires may increase in frequency and intensity if projections of climate warming and changes in precipitation patterns are realized. The likelihood that the ecological effects of climate change will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low.

SSN ESU: The fisher population within the SSN ESU is likely vulnerable to the potentially adverse effects of warming climate due to its small size and relatively narrow and linear distribution. Several studies have modeled climate change effects on vegetation and suggest that conifer forests will decline in distribution, mixed or hardwood forests and woodlands will increase in distribution, and canopy cover in many areas will likely decline (with the shift from forest to woodland vegetation). These models make broad predictions at relatively large spatial scales, and that fine scale ecological variation will likely result in actual changes to forests that are relatively nuanced and site specific. It appears that fishers in the SSN ESU, representing the most southerly occurring population of the species range wide, are already selecting micro-habitats to minimize exposure to heat and limit water loss. A substantial increase in temperature or dryness could render the habitat unsuitable. The likelihood that the ecological effects of climate change will threaten the continued existence of fishers within the SSN ESU in the foreseeable future is moderate.

Factors Considered in Combination

Threat factors, while considered individually to be of low or moderate risk for endangerment, may combine to increase the overall risk of extinction. Increased risk from the interaction of threats may be due to the accumulation of threat risks (additive), or to synergistic effects (effects greater than the sum of the individual threats). For example, sub lethal effects of toxicants may lower the ability of fishers to avoid predation or increase risk of roadkill mortality. Wildfire may fragment the suitable habitat such that predation risk is increased due to the lack of cover in which to hide or by increasing the length of travel routes between safe havens. Climate change could exacerbate wildfire intensity, extent or frequency, which in turn may remove the mesic microclimates needed by fishers to adapt to increasing temperature and shifting precipitation patterns predicted as result of climate change. This in turn could reduce fisher fitness and reproduction, causing the population to decline in the foreseeable future. It is difficult to assess the level of increased risk from all the possible combinations of threat factors; however, the potential increase in extinction risk from these combinations is greater for smaller fragmented populations.

NC ESU: While combined effects of multiple threats, including climate change, loss of habitat, toxicants, and predation are expected to occur in the NC ESU, the likelihood that the combined effects will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low due to the size and widespread distribution of the fisher population.

SSN ESU: The SSN ESU's small population size, limited geographic range, narrow habitat configuration, low reproductive capacity, and inability to rapidly disperse to new suitable habitat make the population more vulnerable to the combined effects of multiple threats. Population size could decline precipitously with modest changes in mortality and reproduction due to any one or a combination of factors. The likelihood that the ecological effects from the combined effects of climate change, loss of habitat (particularly due to wildfires), toxicants, and predation will threaten the continued existence of fishers within the SSN ESU in the foreseeable future is high.

Listing Recommendation

CESA directs the Department to prepare this report regarding the status of fisher in California based upon the best scientific information available. CESA also directs the Department based on its analysis to indicate in the status report whether the petitioned action is warranted (Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f)). The Department makes its recommendation in its status report as submitted to the Commission in an advisory capacity based on the best available science.

NC ESU: Based on its consideration and analysis of scientific and other information available and including independent peer review by scientists with expertise relevant to the status of the fisher, as guided by CESA, the Department recommends that designation of the fisher in the Northern California ESU as threatened or endangered is not warranted.

SSN ESU: Based on its consideration and analysis of scientific and other information available and including independent peer review by scientists with expertise relevant to the status of the fisher, as guided by CESA, the Department finds that while not presently threatened with extinction, the Southern Sierra Nevada ESU is likely to become an endangered species in the foreseeable future due to the combination of threat factors, absent the special protections and management efforts required by CESA. The Department recommends that the petitioned action to list the fisher in the Southern Sierra Nevada ESU as threatened is warranted.

Protection Afforded by Listing

CESA defines “take” to mean “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.” (Fish & G. Code, § 86.). If the fisher is listed as threatened or endangered under CESA, take would be unlawful except as provided by the Fish and Game Code (Fish & G. Code, § 2080).

Take under Fish and Game Code Section 2081(a) is authorized by the Department via permits or memoranda of understanding for individuals, public agencies, universities,

zoological gardens, and scientific or educational institutions, to import, export, take, or possess any endangered species, threatened species, or candidate species for scientific, educational, or management purposes.

Fish and Game Code Section 2086 authorizes locally designed voluntary programs for routine and ongoing agricultural activities on farms or ranches that encourage habitat for candidate, threatened, and endangered species, and wildlife generally. Agricultural commissioners, extension agents, farmers, ranchers, or other agricultural experts, in cooperation with conservation groups, may propose such programs to the Department. Take of candidate, threatened, or endangered species, incidental to routine and ongoing agricultural activities that occur consistent with the management practices identified in the code section, is authorized.

Fish and Game Code Section 2087 authorizes accidental take of candidate, threatened, or endangered species resulting from acts that occur on a farm or a ranch in the course of otherwise lawful routine and ongoing agricultural activities.

As a CESA-listed species, fishers would be more likely to be included in Natural Community Conservation Plans (Fish & G. Code, § 2800 *et seq*.) and benefit from large-scale planning. Further, the full mitigation standard and funding assurances required by CESA would result in mitigation for the species. Actions subject to CESA may result in an improvement of available information about fishers because information on fisher occurrence and habitat characteristics must be provided to the Department in order to analyze potential impacts from projects.

Management and Monitoring Recommendations

The Department has implemented a number of actions designed to better understand fishers in California and to improve its conservation status. These include collaborating with various governmental agencies and other entities including the State Board of Forestry and Fire Protection, CAL FIRE, USFS, BLM, USFWS, private timberland owners/companies, tribes, and universities, to evaluate land management actions, facilitate research, and contribute to the development of effective conservation strategies. In addition, the Department recommends the following:

1. Support research and continue scientific study to define landscape conditions that provide for the long-term viability of fishers throughout their range in California. Focused study to address how fishers use landscapes, including thresholds for forest structural elements used by fishers is also needed.

2. Expand collaboration with timberland owners/managers to encourage conservation of fishers. This includes cooperating in studies of fishers to provide a better understanding of their use of managed landscapes in California.

3. Continue efforts to encourage private landowners to retain and recruit forest structural elements important to fishers during the review of timber management planning documents on private lands.

4. Design, secure funding, and collaboratively implement large-scale, long-term, multi-species surveys of forest carnivores in the state with private and federal partners. Monitoring of occupancy rates is a comparatively cost effective method that should be considered for long-term monitoring.

5. Develop and implement a range-wide health monitoring and disease surveillance program for forest carnivores to better understand the disease relationships among species and the implications of disease to fisher populations. This should include further study and monitoring of the effects of toxicants on fishers and fisher prey.

6. Continue monitoring fishers and their progeny reintroduced to the northern Sierra Nevada and southern Cascades. This includes collecting, analyzing, and publishing information about reproduction, survival, dispersal, habitat use, movements, and trends.

7. In the southern Sierra Nevada, collaborate with land management agencies and researchers to expand connectivity between core habitats and to facilitate population expansion.

8. Assess the feasibility of translocating fishers via assisted dispersal of juvenile fishers or movement of adults from the southern Sierra Nevada population to nearby suitable, but unoccupied, habitat north of the Merced River as a means to strengthen the fisher population in the region. If this assessment indicates translocation is feasible, implement a pilot effort by 2020.

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Comments on the Department of Fish and Wildlife's Final Status Review

July 17, 2015

Humboldt County Sheriff Mike Downey with dead fisher found near trespass marijuana grow.

epic

Keeping Northwest California Wild Since

Dear Fish and Game Commission,

Please accept the following comments on behalf of the Environmental Protection Information Center (EPIC) in regards to the California Department of Fish and Wildlife's final status review.

EPIC is a non-profit, community-based and membership-driven environmental advocacy group with over 37 years of experience protecting forests, watersheds, and wildlife in northwestern California. EPIC was party to the original listing petition for the fisher, which was submitted to the Service in the year 2000. EPIC and its members have a vested interest in the protection and conservation of the fisher on the west coast and in northwestern California in particular.

Based on the multitude of threats, including toxicant exposure, post-fire logging, and the inadequacy of regulatory mechanisms, EPIC recommends the Commission list the Pacific fisher as threatened under the California Endangered Species Act as a single listable entity or as two evolutionarily significant units (ESU).

Conflicts with Federal Listing Recommendation

On October 7, 2014, the U.S. Fish and Wildlife Service proposed listing the Pacific fisher across its historic range as a single listable entity. In doing so, the Service stated:

> <u>Based on our review of the best scientific and commercial data available, we have determined the West Coast DPS of fisher meets the definition of a threatened species under the Act.</u> The main threats to the West Coast DPS of fisher are habitat loss from wildfire and vegetation management, as well as toxicants, and the cumulative impact and synergistic effects of these and other stressors in small populations. We find that the West Coast DPS of fisher is not currently in danger of extinction throughout all of its range because it exists in two separate native populations (one small and one with population size estimates ranging from 258 to 4,018) that have persisted, and it currently exists in three reintroduced populations that provide redundancy, <u>representation, and resiliency for the extant populations . . . . [W]e do find that the West Coast DPS of fisher is likely to become endangered throughout all of its range in the foreseeable future (estimated as 40 years for the West Coast DPS of fisher) based on multiple threats impacting the remaining two extant native original populations and the cumulative and synergistic effects of the threats on small populations in the West Coast DPS of fisher.</u>

Endangered and Threatened Wildlife and Plants; Threatened Species Status for West Coast Distinct /Population Segment of Fisher, 79. Fed. Reg. 60419 (Oct. 7, 2014).
EPIC concurs with the Fish and Wildlife Service's conclusions and recommends that the Commission similarly find that the fisher is threatened across its entire West Coast subspecies and list the subspecies under CESA either as a single entity or multiple sub-populations

Toxicant Exposure

The status review's analysis of potential threats/stressors is flawed in regards to toxicant exposure.

The status review underplays the risk to fisher populations, in particular the NC ESU, from toxicant exposure. While the status review ultimately concludes, "The likelihood that the illegal use of rodenticide or other toxicants will threaten the continued existence of fishers within the NC ESU in the foreseeable future is low,"[1] the status review's narrative description, together with comments from peer reviewers, paints a different picture: Toxicant exposure is likely a population level stressor and threatens the continued existence of fishers in the NC ESU in the foreseeable future.

The findings of the status review are startling and do not reflect the Department's ultimate conclusion that toxicant exposure is a low threat. Among the findings of the status review:

- Large amounts of pesticides, including rodenticides, are found within the range of the NC ESU. (Pg. 95).
- Fishers are directly exposed through the consumption of flavorized baits and through the intentional lacing of food items with rodenticide. (Pg. 96).
- Fishers are indirectly exposed to rodenticide through preying upon poisoned rodents. (Pg. 96).
- Pre-weaned fishers are also exposed to rodenticide, either through placental or by milk transfer. (Pg. 96).

[1] This statement of risk differs from the draft conclusion distributed for peer review. The draft status review stated, "evidence of exposure in fishers and the documented deaths of a number of animals indicate this is a potentially significant threat that should be closely monitored and evaluated. Exposure to toxicants at [marijuana cultivation sites] has been documented in both the NC and SSN Fisher ESU, but there is insufficient information to determine the relative risk to either population." All substantive comments received by the Department from peer reviewers, however,

- In addition to the threat of direct mortality, sublethal effects of rodenticide exposure may also cause reduced fitness (such as reduced ability to hunt, increased susceptibility to disease, etc.) and cause prolonged bleeding after incurring a wound. (Pg. 98).
- Of 58 fishers that died between 2006 and 2011, 79% were determined to have been exposed to anticoagulant rodenticides.
    - Note: In his comments to the Department's status review, Dr. Mourad Gabriel commented, "Since the Plos paper exposure rates for CA fishers has climbed to 86% and mortality from AR alone has climbed to 9 fishers (cite as Gabriel unpublished Data)." (Comment #Eco18). Dr. Gabriel's comments, which indicate a greater threat to fishers than reported in the Department's status review, were not incorporated into the Department's final status review. Thus, the final status review underplays the impact of toxicant exposure to fishers and is not a presentation of the best available science.
- In the Hoopa Valley, within the NC ESU, five of 17 male fisher mortalities resulted from poisoning. (Pg. 97).
    - Note: In his comments, Dr. Mark Higley updated the information, "At Hoopa we have had 7 male and 1 female mortality due to toxicosis. 6 were [anticoagulant poisoning], 2 males were other rat poisons. *Toxicosis is the leading cause of death for male fishers at Hoopa*." (Comment f30) (emphasis added). Dr. Higley's comments, which indicate a greater threat to fishers than reported in the Department's status review, were not incorporated into the Department's final status review. Thus, the final status review underplays the impact of toxicant exposure to fishers and is not a presentation of the best available science.
- There is a correlation between female fisher survival rate and grow sites located within their home ranges; to wit, the fewer grow sites, the greater survival rate. (Pgs. 98–99).
- As of 2015, 13 California fishers were known to have died from anticoagulant poisoining. (Pg. 97).
    - Note: In his comments, Dr. Craig Thompson put this number into perspective: "combined the Kings River and SNAMP research projects have recorded 121 mortalities of collared fishers since 2007. Cause of death has been determined for 93. Seven are direct AR poisoning. That means that 8% of all observed mortality can be directly attributed to AR poisoning, a likely underestimate due to reasons highlighted in the document. Furthermore, it has been shown that a 10% increase in mortality can be sufficient to cause population decline. So if sublethal effects inflate natural mortality by only 2%, a conservative estimate

given the overall exposure rate, *[toxicant exposure] alone can inhibit expansion or even initiate decline*." (Emphasis added).

- Illegal marijuana grows, over a 2 year period covering 2010–2011, covered an area of roughly 32% of the fisher's range within the state. While alarming, this is likely an underestimate as these only count *known* operations and among raided sites, "a high proportion of grow sites are not eradicated and most sites discovered in the past were not remediated and hence may continue to be a source of contaminants. (Pg. 99).
    - Note: EPIC has more recent information on raids of trespass marijuana grows: On September 2, 2014, EPIC filed a Freedom of Information Act request with the U.S. Forest Service for documents pertaining to trespass marijuana growing operations on the Klamath National Forest, Six Rivers National Forest, Mendocino National Forest, and the Shasta Trinity National Forest. In a partial response dated October 20, 2014, the Forest Service indicated that trespass grows are still highly prevalent in the public forests of Northern California. As provided by the Forest Service:

      Number of illegal marijuana growing operations from 1/1/2012 to [October 20, 2014]:
      a. Klamath – 21
      b. Six Rivers – 29
      c. Mendocino – 22
      d. Shasta-Trinity – 94

      Number of plants discovered at each Forest from 1/1/2012 to [October 20, 2014]:
      a. Klamath – 95,685
      b. Six Rivers – 26,039
      c. Mendocino – 36,702
      d. Shasta-Trinity – 319,733.

      (Letter from Scott Harris, U.S. Forest Service, to Rob DiPerna, EPIC (October 20, 2014)). Note, these are only from *raided* grow sites. Only a portion of all trespass sites are raided. The Forest Service has stated that it would not provide EPIC with information on the locations of these raided sites, although the fisher is known to occupy all of these national forests. Furthermore, the letter does not indicate the level of cleanup or remediation of sites.

- On the Hoopa Reservation, one area known to have trespass marijuana operations and where fishers have been found to be exposed and succumbed to rodenticides, there was a "substantial" population decline from 1998 to

2005, which collates with the steep rise in marijuana production in Northern California. (Pgs. 65,

- "Reductions in prey availability due to pesticide use at marijuana cultivation sites could potentially impact fisher population vital rates (e.g., births and deaths) though declines in fecundity or survivorship, or both." (Pg. 103).
    - Note: The timing of impacts is particularly important. Rodenticide is typically applied in early spring to protect young plants and water systems. In spring, a reduction in rodent prey coincides with increased energetic requirements of pregnant or lactating female fishers, increasing the likelihood of miscarriages due to inadequate nutrition or starvation of dependent kits due to reduced fitness of the adult female.
    -

Critically, multiple pieces of information and/or analysis is missing from the status review. As the status review points out, fishers may live near human residences. (Figure 21, Pg. 84). However, the discussion of impacts from marijuana have largely focused on trespass marijuana grows. While these grows have traditionally been associated with fisher exposure to toxicants, the status review ignores private marijuana grow operations. These are more numerous than trespass grows. It is estimated that California supplies 60% of the nation's marijuana supply and much of that comes from the "Emerald Triangle" area of Trinity County, Humboldt County, and Mendocino County. In this areas, we have seen at least a doubling of marijuana operations in the past 5 years. For example, some news reports suggest that around one-fifth, some 30,000 people, are involved in growing marijuana.[2] Estimates of marijuana grow operations in Humboldt County vary, but usually fall somewhere between 5,000 and 10,000 separate operations. And the traditionally defined emerald triangle is expanding: marijuana operations are becoming more common in other rural counties, like Shasta, Siskiyou and Lake counties as well.

Like trespass grows, private operations also exist deep within fisher habitat. To escape enforcement, private marijuana operations are often found deep in the forest or in highly rural areas. The Department of Fish and Wildlife is aware of this issue as well. As part of a Public Records Act request by EPIC, the Department released hundreds of post-marijuana bust reports which attempt to quantify the impacts of these operations. These document that rodenticides are commonly found in private marijuana grows and that their use is comparable to trespass marijuana grows.

In contrast to trespass marijuana grows, much of the attention with private operations has surrounded water diversion in over-drafted waters. As a result, there is an information gap regarding the impact of private marijuana grows on

[2] http://www.thenation.com/article/shelf-life-50/

terrestrial species, such as the Pacific fisher. That said, anecdotal evidence—such as the prevalence of private marijuana grows within the range of the fisher, the widespread use of rodenticides, and the known correlation between fisher deaths and toxicant exposure—suggests that private marijuana grows are likewise impacting fisher populations.

In summation, as shown in the status review, toxicant exposure has been shown to result in significant fisher mortality, that toxicant exposure is widespread, and that there is a collation between toxicant exposure and significant population declines. Given this information, the Department's conclusion that toxicant exposure only poses a low risk is hard to understand. EPIC believes that toxicant exposure is currently having a significant influence on populations in the NC ESU. As a result, in consideration of the synergistic impacts of his factor in conjunction with other risks such as predation, EPIC believes that both ESU populations should be listed under CESA.

Wildfire, Fire Suppression, and "Salvage" Logging

While the effects of wildfire on fishers are poorly understood, there is a considerable body of evidence to suggest that post-fire salvage logging can have a significant adverse effect on the fisher. Salvage logging is generally conducted to meet economic goals or remove hazard trees. Intensive or poorly planned salvage logging can have a variety of negative effects on ecosystems, such as soil compaction, increased erosion, and impacts on insectivorous and cavity-nesting and denning animals. These are impacts to the Pacific fisher.

"Salvage" logging (harvest of fire-damaged trees, both living and dead) also occurs on the vast majority of private timberlands in the analysis area. (USFWS Draft Species Report 2014b at p. 54). The loss of and reduction in the availability and distribution of structural elements and the processes that create them (for example, mistletoe, heart rot fungi, age-related decadence, primarily cavity excavators) can negatively affect fisher reproduction and energy budgets. Also, in many of the ecosystems in the analysis area, these structural elements are important habitat components for fisher prey. Timber harvest and silvicultural techniques such as regeneration harvest, selective harvest of insect damaged and diseased trees, and thinning to promote vigorous stands of trees, often removes the largest trees or focuses on the removal of older, diseased, or decadent trees resulting in the removal and limits future recruitment of rest and den trees. Fuels reduction and fire suppression techniques that focus on the removal or salvage of snags and fire damaged trees may diminish the distribution, abundance, and recruitment of den and rest across the landscape.

The USFWS Draft Species Report further describes potential detrimental effects of post-fire salvage logging. For example, in the context of outbreaks of the mountain

pine beetle and other insects in British Columbia, one study found that reduction in overhead cover may be detrimental to fishers, and they state that wide-scale salvage operation may substantially reduce the availability and suitability of remaining forests for fishers. (USFWS 2014b at p. 72).

On privately managed forestlands in California, salvage logging either post-fire or post-other disturbances is considered exempt from the normal review and approval of timber harvesting plans, and are thus not subject to the normal review required by the California Environmental Quality Act. Salvage logging proposals are treated as "ministerial" actions in the California Forest Practice Act and Rules, thus leaving the Department of Forestry (CAL FIRE) with little to no wiggle room to regulate salvage logging or to ensure adequate mitigation to ensure that essential landscape features necessary for the survival of the fisher and other species are maintained.

On federal lands, post-fire salvage logging is still occurring within potentially suitable habitat for the fisher. For example, the post-fire condition in the analysis area for the Salmon Salvage project in Forest Service Region 5 estimates approximately 10,603 acres of fisher habitat. Other recent salvage logging projects on non-federal lands in Forest Service Region 5 include the Caribou project and the Panther Fire Salvage project. In addition, the 2012 Bagley fire burned over 46,000 acres, 70 percent of which occurred on the Shasta-Trinity National Forest. (U.S. Forest Service 2013; in response to Haines Freedom of Information Act Request (Haines 2013)). Over 23,000 acres of the Bagley fire post-fire salvage project proposed by the U.S. Forest Service was to occur in lands designated as LSRs (*Ibid*). Over 22,000 acres of the project were proposed within areas designated as Critical Habitat for the northern spotted owl. (*Ibid*).

These are just a few examples of salvage logging operations on federal lands that can have detrimental effects on the quality and quantity of fisher habitat. Salvage logging operations on federal lands are not designed for fisher-specific conservation.

On non-federal lands, salvage logging most often occurs under an emergency timber harvest exemption as provided in the California Forest Practice Rules. Logging operations proposed pursuant to emergency exemption notifications are not subject to discretionary review by CAL FIRE; rather, such project applications are merely ministerial permits. In the past, large private industrial non-federal landowners have filed emergency exemptions that cover entire ownerships. Salvage logging on non-federal lands in California is poorly regulated and inadequately monitored.

As an example of this, nearly 25 emergency exemption notifications to conduct salvage logging operations were submitted to CAL FIRE, mostly by Sierra Pacific Industries, in association with the Bagley Fire. One of these emergency exemption notifications alone proposed over 400 acres of salvage logging operations. (CAL FIRE response to Haines Public Record Act Request 2013). Similarly, in response to

the Chips fires, six emergency exemption notifications to conduct salvage logging operations were received by CAL FIRE, once again, nearly all filed by Sierra Pacific Industries. One of these emergency exemptions proposed 'salvage' logging operations over 1,186 acres. (*Ibid.*).

In summary, while the effects of wildfire on fisher life history behaviors are not well understood, there is ample evidence that salvage logging can adversely affect the fisher, both on federal and non-federal lands. Post-fire salvage logging can in fact be more detrimental to the fisher than the actual effects of the fires themselves. The lack of adequate safeguards to address the loss of suitable fisher habitat due to post-fire 'salvage' logging on both federal and non-federal lands is yet another reason why listing of the fisher is warranted.

Safety of individuals engaged in survey and monitoring activities is similarly a concern. Gabriel et al. (2013; M. Gabriel unpubl. data) estimated that safety concerns due to trespass outdoor marijuana cultivation resulted in exclusion of researchers from 15-25% of one fisher study area in California and a projected additional cost of $500,000-750,000 for the life of the combined budgets of two of California's fisher research projects.

The magnitude and immediacy of threat posed by outdoor marijuana cultivation to the survival and recovery of the Pacific fisher in the wild is significant. ESA listing and associated management techniques are necessary to curtail these threats to the fisher.

Inadequate Regulatory Mechanisms

Here we present the inadequacy of existing regulatory mechanisms as it pertains to Northwest California federal and non-federal land management.

Federal lands in Northwestern California are primarily administered by Region 5 of the U.S. Forest Service, and are subject to the provisions of the Northwest Forest Plan. Reliance on the federal lands LSR system to provide for conservation of the northern spotted owl and other late-seral-dependent species has not been sufficient to curtail the decline of the owl, and will not be sufficient to ensure conservation and recovery of the fisher. It is interesting to note that recent estimates have shown that only about 36% of LSRs actually include late-successional forests, with the majority of the designated reserves expected to acquire such conditions over decades (Strittholt et al. 2006). Thus, as noted elsewhere, reliance on the existing LSR system for late-seral associated species on federal lands has proven inadequate.

On non-federal lands in Northwest California, timber harvest and other wood-producing activities are governed by the Z'berg Nejdely Forest Practice Act of 1973 (California Public Resource Code section 4511 et seq.) and the associated California

Forest Practice Rules (California Code of Regulations Title 14, section 895 et seq., hereafter "Rules"). As described in the Center for Biological Diversity's petition to list the fisher under the California Endangered Species Act (CESA) (CBD 2008) the Rules allow significant alteration of fisher habitat and do not provide protection of elements essential to fisher habitat, such as large trees, snags and downed wood, and high canopy closure. The lack of direction to protect these habitat elements has resulted and continues to result in degradation and destruction of late successional habitat utilized by the fisher. Beardsley et al. (1999), for example, conclude:

> Any increase in old-growth area in the Sierra Nevada ecosystem, would have to come mostly from the unreserved areas of the national forests, because these forests contain most of the forests having a mean diameter greater than 21 inches (59,000 acres of that was already old-growth). Most of the area in private ownership is expected to be managed for non-old-growth values.

Lack of forests with late-successional characteristics on private lands is not surprising given that the applicable Rules require maximizing timber production utilizing intensive logging methods, and fail to provide any effective protection for fishers.

A review of 2013 non-federal Timber Harvest Plan (THP) statistics for the state of California shows the use of intensive forest management techniques within the range of the Pacific fisher. According to information provided by the THP tracking center, nearly 20 percent of total proposed timber harvest acreage in the state consists of clearcutting or similar alternative method most closely resembling clearcutting. (Haines 2014). In addition, another nine percent of total state-wide timber harvest proposal acreage is planned as sanitation-salvage logging operations. (Haines 2014). Finally, and additional 28 percent of the total proposed THP acreage in the state consists of group selection silviculture. (Haines 2014).

County-specific information is also provided in Haines (2014). For Del Norte County, 77 percent of total proposed timber harvest acreage is projected as clearcutting or a similar alternative method. For Humboldt County, 28 percent of the total proposed timber harvest acreage is projected to be accomplished via clearcut silviculture. (Haines 2014). For Trinity County, 59 percent of the total proposed timber harvest acreage is proposed to be accomplished via the application of clearcut silviculture or similar alternative method. (Haines 2014).

Clearcut silviculture leaves large swaths of patchwork openings throughout the forested landscape within the range of the fisher in Northwestern California. Clearcut units can be as small as 10-15 acres, but can also be as large as 40 acres or even larger, if explained and justified in the THP. The Rules do not provide for

retention of a minimum number of snags or other wildlife tree elements within evenaged (clearcut) units.

Few or none of the logging prescriptions described in the Rules would result in retention of habitat features critical to the maintenance of Pacific fisher populations on non-federal land. Logging practices within the range of the Pacific fisher appear to be intensive, sometimes affecting each acre an average of six times over an eight year period. Further, the Rules do not provide any measures that offer explicit protection for the fisher, provide no effective measures to protect fisher habitat in any meaningful quantity, and fail to provide a mechanism for identifying individual or cumulative impacts to the fisher or its habitat on private lands. Finally, there is no evidence to support claims that protections for the northern spotted owl, marbled murrelet, or anadromous fish are sufficient to protect the fisher. The net result is that the Rules do not regulate logging on private lands in a manner that is adequate to maintain fisher habitat or populations on private land within California.

In addition to the lack of adequate mechanisms to regulate timber harvest for the benefit of the Pacific fisher on federal and non-federal forestlands, it must be reiterated that existing mechanisms to regulate illegal and egregious trespass marijuana agriculture and the potential associated use of anticoagulant rodenticides are similarly inadequate. State wildlife officials and law enforcement officials currently have few legal or regulatory mechanisms to ensure best management practices on either trespass or cottage industry marijuana growing operations. Unless illegal trespass marijuana growing on federal lands is curtailed, the potential negative effects on fisher populations are likely to continue.

Summary

The myriad and immediacy of threats to the conservation of the Pacific fisher demonstrates the need for immediate action. EPIC believes that the status review adequately discusses the current science but fails to draw reasonable conclusions from that science. EPIC urges the Commission to list both ESU populations as threatened under CESA.

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Sierra Pacific Industries

Forestry Division • P.O. Box 496014 • Redding, California 96049-6014
Phone (530) 378-8000 • FAX (530) 378-8139

July 30, 2015

California Fish and Game Commission
1416 Ninth Street
Sacramento, CA 95814

Re: OPPOSE the Proposal to List the Fisher as Threatened or Endangered Under the CESA

Dear Commissioners:

In California, Sierra Pacific Industries (SPI) owns 721,814 acres of forest land currently occupied by fisher. SPI also owns 849,149 acres which, while currently unoccupied by fisher, contains equally suitable habitat for fisher when they arrive via natural expansion or by future translocation efforts.

SPI reviewed the CDFW's analysis of the status of fisher in California and find it is well written and comprehensive. It is also responsive to the views of fisher experts. Below, we add additional background information as the Commission makes its decision. However, SPI believes the fisher is a very resilient species which does not warrant California Endangered Species Act (CESA) listing.

SPI is actively participating in a fisher reintroduction project in cooperation with the California Department of Fish and Wildlife (CDFW), the US Fish and Wildlife Service, and North Carolina State University. This partnership translocated 40 fisher from several sites in northwestern California to SPIs forestland northeast of Chico. This area is actively managed for trees. The researchers have declared that this translocation effort has successfully established a new population. SPI is continuing to support this research effort for an additional two years to allow these independent researchers to determine population stability and persistence. Although our project partners have not conclusively determined whether the new population will persist long –term (is stable or increasing), SPI believes the rates of fisher reproduction, the increased weights of tracked fishers, the establishment of reasonably-sized home ranges by fishers, and that fishers born after translocation have successfully reproduced in the translocation area, point to a high likelihood of success. SPI has committed to invest well over $1 million over the next few years to complete this project. This cooperative study has already provided valuable insights on fisher den structures and den timing that all landowners in the fisher occupied ranges have been using in the THP process to better avoid fisher take while it is a candidate. (Sierra Pacific Industries 2012)

SPI believes forest management is compatible with fisher reproduction and survival -- provided elements for water, shelter, denning, and prey are also available. To this end, we are intentionally leaving old snags, green cull trees, oaks with cavities, and other structural elements across our ownership. In addition, we and many other landowners are leaving legacy structures

in the form of habitat retention islands where the processes, that create the microsites which provide future dens, will continue to produce these elements through time.

A CESA listing especially limits private landowners from actively managing for listed species since the typical requirement from CDFW is a large acreage set aside protection buffer for the listed species on any permitted project a landowner might wish to implement. This being even more problematic with a wide ranging and elusive species. Continuing forward with this CESA listing would also have a chilling effect on future translocation efforts, which based on our experience is a demonstrated successful process to aid the fisher in its continuing effort to re-inhabit its historic range in California. Even without the Butte County reintroduction data, a recent paper by LaPoint et al. (2015) indicates fishers on the west coast are increasing, albeit slowly compared with eastern and central US populations.

In northwest California, fishers are frequently detected on motion-sensing camera surveys. Models based on CDFW camera surveys indicate the probability of detecting fishers (96.1% over a 30-day sample period) is the second highest species after gray foxes (99.4% probability) (Furnas et al. 2015).

Fishers on interior California timberlands are healthy and reproducing. A study of Klamath River fisher following the removal of individuals (estimated to be 15% of the population over the 2–year removal period) for the translocation work showed no adverse population effects to the remaining fishers. This supports the CDFW recommendation to not list the northwest California population.

SPI disagrees with the recommendation that the southern Sierra population should be treated differently from the northern California population. A review of the CDFW analysis indicates:

- The southern Sierra population is stable.
- The landscape has not changed since the last evaluation by your Commission.
- In the southern Sierra Nevada, about 71% of the fisher occupied area is already designated as Wilderness, National Park, Southern Sierra Fisher Conservation Area, or other lands predicted to provide intermediate or high quality habitat for fishers. (See page 83 of the CDFW fisher report.)
- Threats are minimal and they have not changed since the Commission's last evaluation.
- Genetic analysis indicates the southern Sierra population has been around for at least 1600 years. This alone should give the Commission confidence that the claimed small population size or the genetic isolation cause increased risks. SPI believes 1.6 millennia is enough time to demonstrate they aren't high risks.

SPI believes the Commission should not list the species or any portion thereof, but rather it should encourage the CDFW to partner with landowners and the federal government to expand the range of the fisher into the currently unoccupied and apparently suitable portions of the Sierra Nevada.

As a comparison, a rough total fisher population in California is nearing 5,000 individuals spread over some 20 million acres of suitable habitat. According to New York State in its recently released Fisher Management Plan (NYSDEC 2015), they have a comparable estimated population of 5,000 fisher located on 20 million acres. The New York State Department of Environmental Conservation is proposing to authorize a trapping season (killing) program for up to 20% of that population annually.

California's Fish and Game Commission should take the lead to support and encourage future translocation efforts and decline to list this species.

Sincerely,

Daniel J. Tomascheski
Vice President - Resources

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THE JOHN MUIR PROJECT of EARTH ISLAND INSTITUTE

P.O. Box 897
Big Bear City, CA 92314
Tel: 530-273-9290

July 23, 2015

California Fish and Game Commission
fgc@fgc.ca.gov

Re: Fisher CESA Listing

Dear Fish and Game Commission,

I support listing the fisher under the California Endangered Species Act. I am also writing to provide additional information relevant to your listing decision, particularly research that I have conducted regarding Pacific fishers and wildland fire, and effects of pre- and post-fire management. As explained below, this research, as well as much more, demonstrates that post-fire logging is a serious threat to fishers, and therefore is an important reason to list them and protect them under CESA.

In a nutshell, my two research studies regarding fishers and burned forests have found that post-fire landscapes, when left unlogged, can provide critical habitat to fishers. In Hanson (2013), using specially trained scat-detecting dogs to assess the frequency of Pacific fisher scat detections/km of survey transect in different habitat types, I analyzed Pacific fisher habitat selection in post-fire habitat and adjacent unburned forest on Sequoia National Forest. Specifically, I analyzed fisher habitat selection by fire severity and pre-fire structure/composition--both dominant size class and canopy cover--and forest type (see Abstract, and Results at p. 26, of Hanson 2013). In my Methods (see p. 25 of Hanson 2013), I described the fire severity categories analyzed, and the level and range of tree basal area mortality associated with each, where higher-severity was defined as 50-100% basal area mortality. I found that, in unburned forest, fishers selected areas of dense, mature/old conifer forest significantly more than open or young forests (Hanson 2013, Table 2b). I also found that, within fire areas (not subjected to post-fire logging), fishers similarly selected areas where the pre-fire condition was dense, mature/old conifer forest, as opposed to areas where the pre-fire forest was open or young (Hanson 2013, Table 2a). This relationship was not statistically significant at the 0.05 significance level, but was significant at the 0.10 significance level (Hanson 2013, Table 2a), which is often used in studies pertaining to wildlife habitat selection. This indicates that fishers are selecting dense, mature/old conifer forest in its unburned, and burned, states. Further, I found that the proportion of higher-severity fire was significantly higher within 0.5 kilometers of fisher detection locations than at random locations, indicating that fishers are selecting areas with relatively higher levels of higher-intensity fire for foraging (Hanson 2013, Figure 2). When fishers are near fire perimeters, they strongly select the burned side of the fire edge (Hanson 2013, Table 3). Both males and female fishers are using large mixed-intensity fire areas, such as the McNally fire, including areas >10 kilometers into the fire area.

Moreover, I gathered additional data in the 61,000-hectare McNally fire of 2002, using the same methods described in Hanson (2013), but focused mainly in large higher-severity fire patches, and found very strong use of large, intense fire patches in dense, mature/old conifer forest, especially by female fishers. My findings are in-press in a new study, Hanson (2015). In Hanson (2015), the

current hypothesis among land managers that fishers will avoid higher-severity fire areas was rejected, and fishers used unlogged higher-severity fire areas at levels comparable to use of adjacent unburned dense, mature/old forest. Female fishers demonstrated a significant selection in favor of the large, intense McNally fire over adjacent unburned mature/old forest, and the highest frequency of female fisher scat detection was over 250 meters into the interior of the largest higher-intensity fire patch (over 5,000 hectares).

For the reasons explained above, my research—which is the only research that has been conducted specifically on the relationship between Pacific fishers and unlogged, wildland fire—indicates that post-fire logging is a serious threat to Pacific fishers and is yet another reason to list them under CESA. This is consistent with Bull et al. (2001), who concluded that, with regard to fishers in eastern Oregon and Washington, "[s]alvage harvesting, thinning, and conversion of predominantly fir stands to ponderosa pine (*Pinus ponderosa*) may adversely affect habitat conditions for fishers."

Please don't hesitate to contact me if you have any questions. Thanks.

Sincerely,

Chad Hanson, Ph.D., Director and Staff Ecologist
John Muir Project
P.O. Box 897
Big Bear City, CA 92314
530-273-9290
cthanson1@gmail.com

References

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CENTER *for* BIOLOGICAL DIVERSITY

July 23, 2015

SENT VIA EMAIL

California Fish and Game Commission
1416 Ninth Street
P.O. Box 944209
Sacramento, CA 94244-2090
Fax: (916) 653-5040
Email: fgc@fgc.ca.gov

Re: Agenda Item Number 22 (Decision on whether to list fisher (*Pekania pennanti*) as a threatened or endangered species)

Dear Commission:

The Center for Biological Diversity offers the below comments regarding Agenda Item Number 22 at your upcoming August meeting: Decision on whether to list fisher (*Pekania pennanti*) as a threatened or endangered species. The Center is a non-profit, public interest, conservation organization dedicated to the protection of native species and their habitats through applying sound science, policy, media, and environmental law.

Found in the dense, conifer forests of far northern California and the southern Sierras, fishers are remarkable carnivores, well known for their ability to prey upon porcupines. Due to the fishers' small population size, loss of habitat, and numerous threats, the Center first petitioned the State of California to list the fisher under the California Endangered Species Act in 2008. After the petition was denied in 2010, the Center sought and received a court order overturning the petition denial, and as a result, the Department of Fish and Wildlife commenced a new status review for the fisher in 2012. As you know, that report was recently submitted to you.

Because fishers in California currently exist in two separate populations that are isolated from one another – one in far northern California and one in the Sierras – the Department of Fish and Wildlife evaluated the status of each of these populations separately. The Department's report recommends listing fishers in the Sierras, but not in northern California. While we support separate consideration of these two populations, we believe it is also critical to list fishers in northern California because the threats they face are identical to those of fishers in the Sierras, and moreover, the fisher population in northern California, like that in the Sierras, is likely very small. Principles of conservation biology strongly argue in favor of protecting such small, isolated populations, and we therefore urge you act in a precautionary manner and list both populations to ensure their long term well-being. There is a great deal of substantial evidence to find that listing is warranted for both populations and below we offer specific bullet points to guide your decision-making:

- The fisher population in northern California, like the population in the Southern Sierras, is likely very small. While the actual population numbers are unknown, the data presented by the Department suggests that both populations are likely well below thresholds of extinction concern. For example, Traill et al. (2007), in a meta-analysis of numerous studies on multiple taxa, found that mammal populations less than about 3,800 individuals are at a significant risk of extinction in the near future, and the degree of risk increases as a population falls farther below this threshold (see Traill et al. 2007 [Table 2]). For this reason alone, both populations, not just the Sierra population, should be listed. Furthermore, fishers possess traits that increase their vulnerability to extinction related to their small population size. They have low reproductive rates, their colonizing ability is limited, and they are slow to recover from deleterious impacts.

- Fishers continue to face numerous threats:

    - Timber harvest methods that occur on private lands within the fisher's range eliminate/reduce important forest elements that fisher rely upon such as snags; large, decadent trees; and dense, complex forest structure with high canopy cover. For example, clear-cutting eliminates all attributes of a forest that fisher rely upon, while other methods (e.g., selection, sanitation salvage, thinning) eliminate important forest attributes such as large trees, snags, and understory.

    - The U.S. Forest Service, on public lands, continues to use and intends to expand the use of timber harvest methods (group selection, commercial thinning) that impact forest attributes that fishers select and create conditions that fishers have been found to avoid. For example, Truex and Zielinski (2013) found the following as to Forest Service lands: "There were significant negative effects of [thinning] treatment on predicted resting habitat suitability at both study areas, and highly significant effects on canopy closure . . . ." Similarly, Garner (2013) "used location data for 36 individual fishers (27 female, 9 male) to study second-order (home range and core-use area) and third-order habitat selection (resting and foraging sites) of national forest lands treated with management activities between 1992 and 2006." Garner found that "when selecting microsites within their home ranges, fishers tend to avoid using sites within 200 meters of a treated [thinned] area." Garner further found that "as fishers are selecting foraging and resting sites within their home ranges (third-order selection), they tended to avoid treated areas in favor of sites within untreated forest, corroborating previous findings (Truex and Zielinski 2013)."

    - Whereas the best available science shows that fishers react negatively to mechanical treatments, fishers evolved with fire. Historically, many western forest types were heavily influenced by fire – including severe fire – which is natural and necessary to maintain the integrity of forest ecosystems. Despite the importance of fires to the health of a forest, the Forest Service suppresses the majority of fires, thus preventing natural fire processes form occurring within the fisher's range.

While little research exists regarding the relationship between fishers and fire, two research efforts have examined fisher use of a post-fire landscape in the Sierras. The studies – Hanson (2013) and Hanson (2015) – used specially trained fisher scat-detecting dogs to determine patterns of habitat use and found that fishers select dense, mature forest in both its unburned and burned condition. Hanson (2013) found that at the spatial scale of "500-m radius around scat detection locations within fires, fishers selected areas with greater proportions of higher-severity fire [50% basal area mortality or greater]." And Hanson (2015) found that fishers used unlogged mature forest areas that had burned severely at levels comparable to use of adjacent unburned mature forest. Female fishers in particular demonstrated a significant selection in favor of the severely burned forest.

The above research illustrates that it is important to not assume that fire is inherently harmful to fishers. Rather, what is likely harmful to fishers is the post-fire logging that occurs and which eliminates or reduces the ability of post-fire landscapes to provide critical habitat to fishers. Post-fire logging in mature forest on public lands is still common. For example, just this summer alone, within the range of the fisher, are two post-fire logging projects – the Westside Project on the Klamath National Forest, and the French Project on the Sierra National Forest. Such logging destroys the dense, complex, post-fire habitat that fishers make use of in burned areas.

- Heightened predation has been identified by recent research (e.g., Wengert et al. 2014) which may be related to the above forest management practices that harm fisher habitat.

- Mounting evidence exists that toxicants, especially rodenticides, are pervasive and widespread due to activities like illegal marijuana growing (see, e,g., Gabriel et al. 2013). Fishers regularly come into contact with toxicants due to the presence of illegal groves in forested areas of northern California and the Sierras. The fishers can come into direct contact with the rodenticides or can consume them when they eat prey that has consumed the rodenticide. The extent of the problem has been and continues to be researched, and the data indicates that the problem is likely growing worse in terms of exposure and harm. Moreover, efforts to curb the availability of rodenticides do not appear to have improved the situation for fishers, and in fact, it appears that illegal rodenticide use is instead still increasing.

- Inadequate regulations allow destructive logging methods to continue on both private and public lands. For example, the California Forest Practices Rules allow clear-cutting within the range of the fisher, as well as many other practices that eliminate or at least reduce the forest characteristics that fishers are associated with, such as large trees, snags and downed wood, and high canopy closure. Moreover, private timber owners regularly report that there does not exist any late-successional forest, or even large old trees, in their area. On public lands,

> there exist very few restrictions on the use of mechanical treatments within the range of the fisher despite findings that fishers avoid treated areas, and there do not exist any meaningful restrictions as to post-fire logging on public lands.

We hope the Commission will issue a positive listing decision for both fisher populations, thus providing fishers the protections, as well as other support, that CESA describes. For example, besides precluding the killing of listed species, CESA requires that projects rely on the best available science when examining a project's harm to a listed species, and CESA also provides for financial support for conservation actions for listed species. *See, e.g.,* Cal. Fish and Game Code §§ 2051-2081.

As discussed above, the two native fisher populations in California are isolated from one another, are very small, and face extensive threats. These factors and threats illustrate that, from a cumulative perspective, the fisher populations are at great risk in California and should therefore be provided the protections of CESA. Moreover, in making a determination, the Commission should err on the side of conservation and provide the benefit of the doubt to the species in situations where the data in not definitive. Doing so will ensure that CESA's intent – protecting species before it is too late – is met.

Thank you for considering these comments.

Respectfully submitted this 23rd day of July, 2015,

_____

Justin Augustine
Center for Biological Diversity

From: [redacted]
To: FGC
Subject: support for listing fisher as endangered species
Date: Saturday, July 18, 2015 4:52:13 PM

Please list the fisher as an endangered species in California -- and if that is not sufficiently warranted scientifically for some reason then please at least list it as threatened in this state.

Since other animals do not belong to humans at all, the least we can do is assiduously try to protect them as much as possible, after all the harm people have inflicted on them. And non-human carnivores everywhere need all the help they can get.

Thank you --

Melissa Miller
West Covina, California

Calforests
California Forestry Association

1215 K Street, Suite 1830
Sacramento, CA 95814
916.444.6592

July 23, 2015

Mr. Jack Baylis, President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

RE: Calforests Urges the Fish and Game Commission to Reject Listing of Pacific Fisher

Dear President Baylis and Fish and Game Commissioners:

Calforests (the California Forestry Association) submits the following comments with regard to the potential listing of the Pacific fisher by the Calif. Fish and Game Commission (Commission). Calforests represents forest landowners, professional resource managers, and producers of wood products and biomass throughout California. Many of our members own, or are dependent on timber supply from the forested land within the range of the fisher. They manage their lands not only to provide a sustainable timber supply for the manufacture of wood products that Californians and citizens around the world rely on, but also to ensure that public trust resources on those lands are adequately protected for future generations. One of these public trust resources includes protecting and providing functional habitat for the fisher on these private forestlands.

Starting in 2009, Calforests has previously submitted comments to the Commission along with an extensive compendium that included the most comprehensive dataset of fisher population and habitat data on private lands in California. These data were collected from a variety of large private forest landowners throughout the range of the fisher, and many of these landowners have been studying, monitoring, tracking, and protecting the fisher and its habitat for decades. We request all previously submitted data from Calforests (and the California Forestry Association) be included in the record for this hearing.

In addition, several large landowners have participated in an experimental relocation of fishers onto private forestland in the Northern Sierra Nevada range. The results of this relocation have been very successful, with the relocated fishers prospering and reproducing.

The conclusions that can be drawn from this compendium are simple: the fisher population is stable across its range and the fisher does not need California Endangered Species Act listing by the Commission. We feel that the Calif. Dept. of Fish and Wildlife's (DFW) Status Review of the fisher totally supports this argument. Their status review, which compiled fisher information statewide, shows again that the fisher population throughout its Northern California range is stable to expanding.

Calforests also believes the southern population of fisher does not warrant listing. This population south of Yosemite is indeed isolated from the other main population of fishers to the north. This isolation is not a recent event. The best science suggests that it has been in place for 1,600 to 16,000 years, which would certainly be long enough for negative effects of small population size or genetic isolation to be expressed. However, reviewing the population over time, this southern group of fishers remains a stable and viable population. Population estimates provided to the Commission in the compendium, based on actual density studies, supports our claim that there are many more fishers in this population than presented in the listing petition.

Calforests respectfully requests that the Commission vote NOT to list either population of fisher at its August 2015 meeting and hearings. We believe that the Commission, in their original September 21, 2010 vote to deny the listing of the fisher, looked at the information presented to them by the Calif. Dept. of Fish and Game (Department) and made an intelligent, informed decision based on the population and habitation facts presented to them by the Department. Since that time, updated population information summarized by the Department's Status Review further attests to even higher fisher population numbers.

Calforests previously outlined some specific reasons why the fisher should not be listed and these reasons are restated below:

1. Fisher populations in California are robust and stable. Population estimates made by Self, et al, in 2008 and 2009, indicate there are roughly 3,700 fisher in California, approximately 3,200 in the northern population and 500 in the southern population. These population estimates were based on actual density studies and represent a credible methodology to obtain a realistic population estimate. These numbers are several times larger than the population estimates included in the original listing petition. In addition, several large private landowners who have monitored fisher populations over time on their lands have determined that fisher populations are stable or even increasing over time.

2. Fisher do not require old growth or late successional stands. Several studies conducted in California clearly indicate that a well-distributed fisher population exists in second growth forest stands on California's private forestlands. This is in direct contradiction of the listing petition's claim that fisher are dependent upon old growth and late successional stands. The DFW lead cooperative Stirling Area Translocation effort is clear testimony to this fact as there is now an established new population on managed industrial timberlands.

3. Regulatory processes and landowner management practices protect fisher populations and habitat. State regulations — primarily through the California Forest Practices Act — establish minimum protection measures for fisher, including the retention of key fisher habitat trees. In addition, voluntary management practices established by several

large private landowners that represent nearly 2.4 million acres of forestland within the fisher's range, provide additional protections and habitat retention and improvement measures.

The Commission is faced with an important decision regarding the fisher. We believe that contrary to the misleading information presented in the listing petition, the credible, scientific numbers from both the Calforests' Fisher Compendium and from the Department's Status Review validate our recommendation that the fisher NOT be listed in California.

The Commission made a well-informed decision in 2010 to initially reject the fisher listing petition. Given the strong evidence to show that there are even more fisher than previously thought, we urge the Commission to once again reject this listing petition.

Thank you for the opportunity to comment on this very important matter.

Sincerely,

David A. Bischel
President

GREEN DIAMOND RESOURCE COMPANY

California Division 707-668-4400
Timberlands Division

July 23, 2015

Mr. Jack Baylis, President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

VIA EMAIL: "fgc@fgc.ca.gov"

RE: Green Diamond Resource Company Requests the Fish and Game Commission Reject Listing of Pacific Fisher

Dear President Baylis and Fish and Game Commissioners:

Green Diamond Resource Company previously submitted comments to the Commission starting in 2009 regarding the pending listing of the Pacific fisher. This information included summaries of fisher occurrences on our North Coast timberlands. We respectfully request that all previously information submitted be included in as part of the record for this hearing.

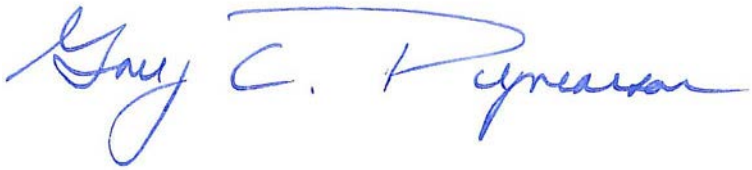
Green Diamond owns and manages approximately 375,000 acres of land in California's north coast region. It has long worked closely with state and federal resource agencies to conserve threatened, endangered and other sensitive species and habitats on our land. As part of those stewardship efforts, Green Diamond has conducted numerous extensive studies of fishers on its land since the early 1990s. These studies have shown that Green Diamond Timberlands contain some of the highest known densities of Pacific fishers. These populations are occurring in young-growth timberland where we have retained key habitat elements such as larger-diameter trees, snags, wildlife trees and downed logs.

We believe the record clearly shows that: (1) fisher distribution in California has not changed since the 1920s; (2) the fisher population in California has not decreased, and has likely increased, since the 1920s; (3) the current fisher population trend in California is stable and perhaps slightly increasing; (4) the historic main threat to fishers (trapping) ended in the 1940s; (5) timberland management and harvesting does not pose a threat to fishers; (6) other threats faced by fishers do not rise to the level of threatening the species with extinction; and (7) existing land management and regulatory mechanisms currently provide certain protections and benefits to fishers and their habitat, fishers in California cannot possibly be considered to qualify as either "endangered" (i.e., "in serious danger of becoming extinct throughout all, or a significant portion, of its range") or "threatened" (i.e., likely to become endangered in the foreseeable future).

The new “Status Review Report” raised issues regarding potential impacts of illegal marijuana grows and the species exposure to pesticides. Green Diamond closely monitors its property for trespass grows and maintains locked gates to control access. When marijuana grows are located the sheriff’s department is notified and the grow is eradicated. A recent study by DFW (Bauer, et al 2014) found low occurrence of trespass grows on Green Diamond’s timberland ownership in the Redwood Creek drainage (northern Humboldt County). The study showed high densities of grow sites in subdivided wildlands, but few grow sites on the adjacent Green Diamond timberland ownership where gates and routine inspection are effective in excluding illegal grows and associated misuse of water resources and pesticides.

Based on the findings of both the original and new Status Review reports conducted by the Department, we concur with the Department that the Pacific fisher does not warrant listing in our region and we respectfully request the Commission decide against listing this species under the California Endangered Species Act.

Sincerely,



Gary C. Rynearson, Manager Forest Policy and Communications