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.*

TABLE OF CONTENTS

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).

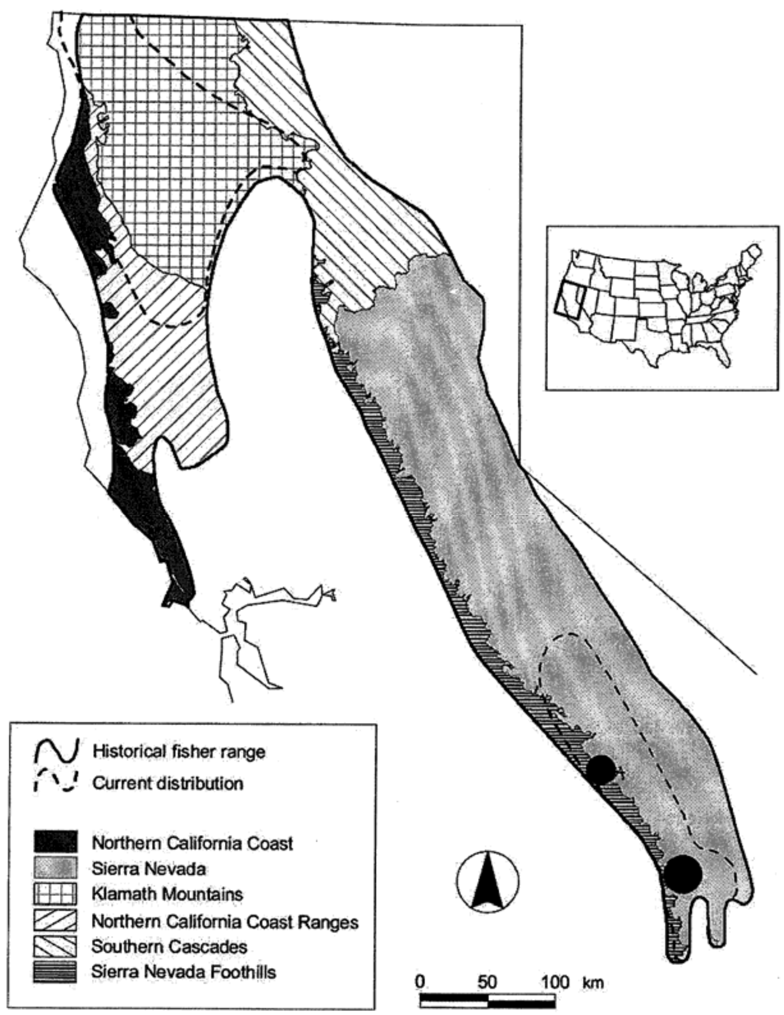

Figure 1. Map of the fisher's historic and current range in North America from Zielinski et al. (2005a).

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*).

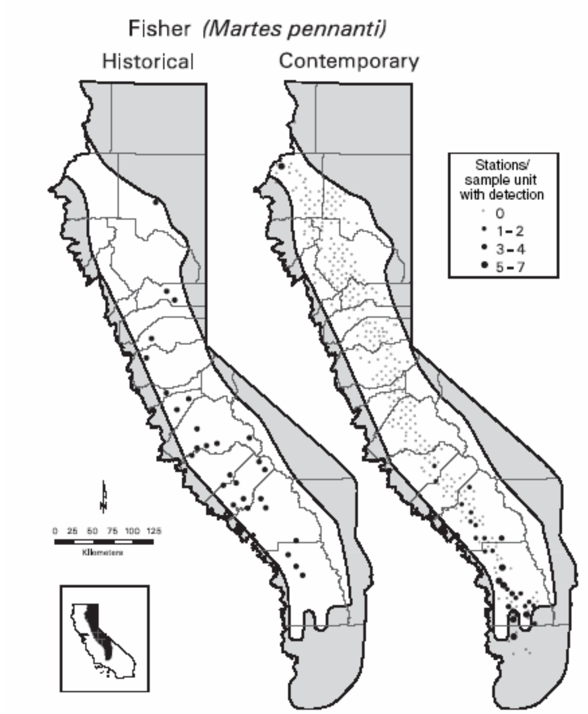

Figure 2. Distribution of historical records (left) and contemporary survey data from 1992-2002 (right) for the Pacific fisher in the Sierra Nevada. Historical range indicated by bold black line; gray dots on contemporary map are sample units where no fishers were detected; black dots represent stations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

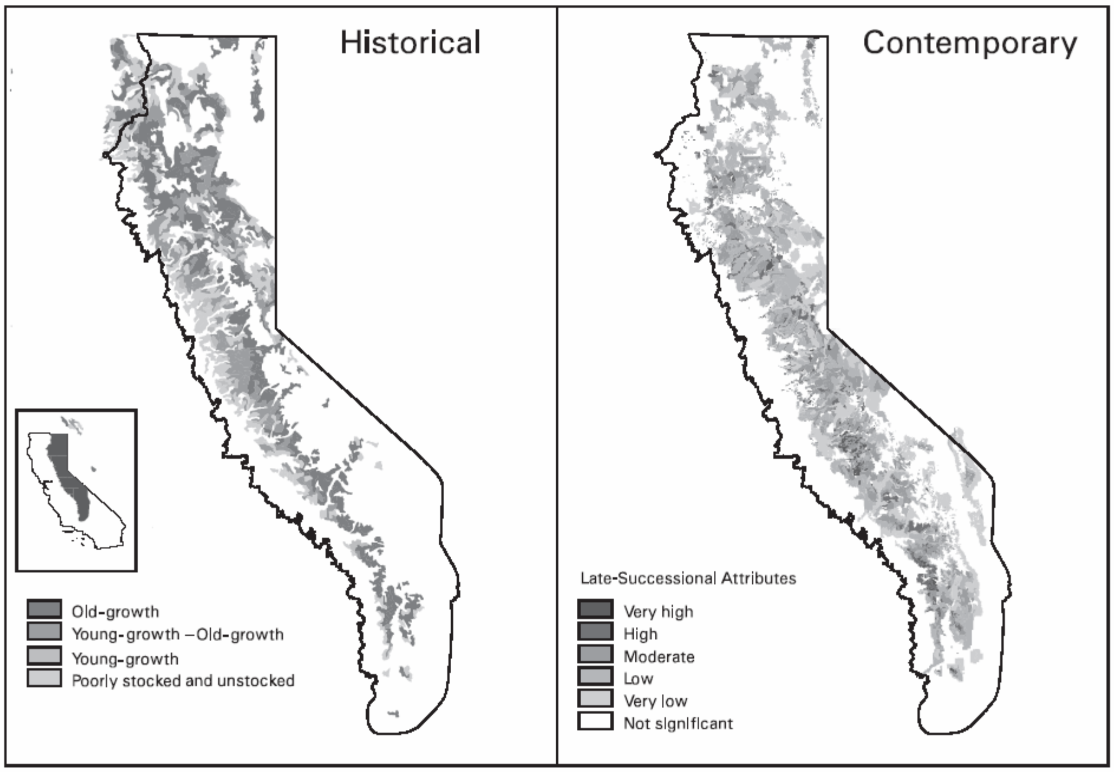

Figure 3. Maps of historical (Weislander Vegetation Type Survey, 1929 and 1934) and contemporary (Sierra Nevada Ecosystem Project, 1996) old-growth forest cover in the Sierra Nevada. From Zielinski et al 2006.

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. ≥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**

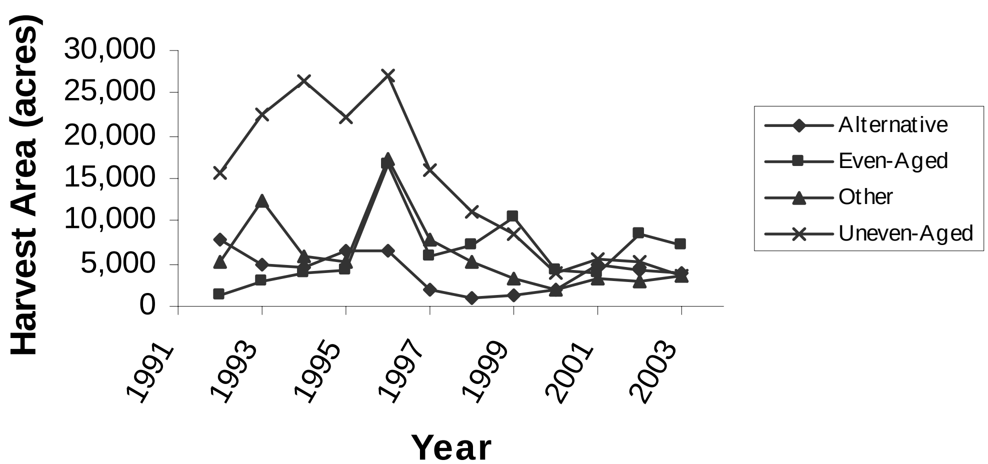

Figure 4. Trend of silvicultural prescription types used on private lands in the Southern Forest District of the Sierra Nevada from 1992 to 2003. Data values from Table 11 above.

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:**				**Period**	**Source**
	Roads	**Agriculture**	**Urban**	**Total (acres)**		
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."

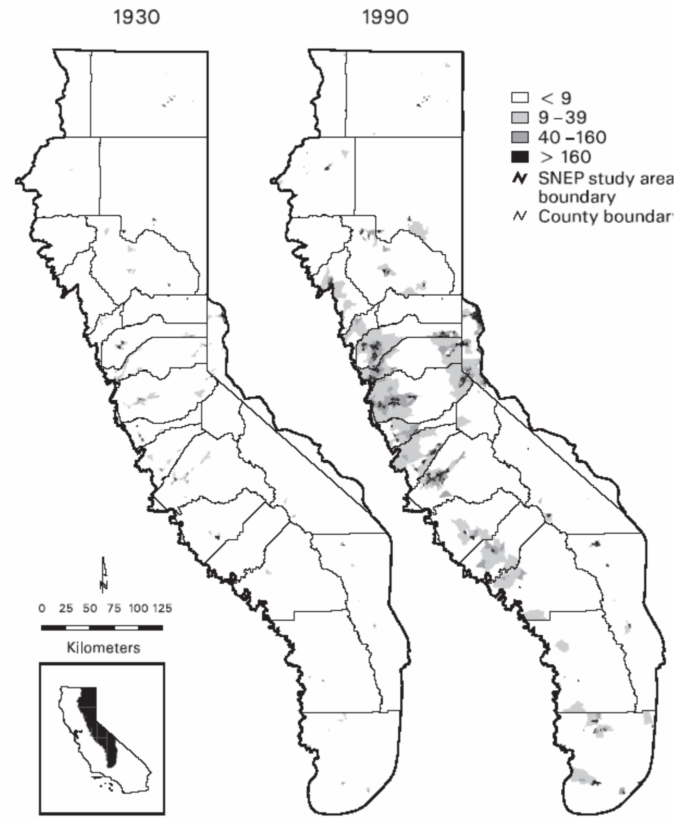

Figure 5. Housing densities per square mile in 1930 and 1990 for the Sierra Nevada from U.S. Census Bureau data. From Zielinski et al. (2005a).

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).

---

[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."

[2] *Earth Island Institute v. U.S. Forest Service,* 442 F.3d 1147 (9^{th} 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.

[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.

<u>The Northwest Forest Plan</u>

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 ≥ 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., ≥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

The Center for Biological Diversity works through science, law, and creative media to secure a future for all species, great or small, hovering on the brink of extinction

REFERENCES

Agee, J. K. 1993. Fire Ecology of Pacific Northwest Forests. (First ed.): Island Press.

Anderson, E. 1994. Evolution, prehistoric distribution, and systematics of Martes. In S. W. Buskirk, A. S. Harestad, M. G. Raphael, & R. A. Powell (Eds.), Martens, sables and fishers: biology and conservation (pp. 13-25). Ithaca, NY: Cornell University Press.

Arthur, S. M., and W. B. Krohn. 1991. Activity patterns, movements, and reproductive ecology of fishers in southcentral Maine. Journal of Mammalogy, 72, 379-385.

Arthur, S. M., W. B. Krohn, and J. B. Gilbert. 1989. Home range characteristics of adult fishers. Journal of Wildlife Management, 53(3), 674-679.

Arthur, S. M., T. F. Paragi, and W. B. Krohn. 1993. Dispersal of juvenile fisher in Maine. Journal of Wildlife Management, 57, 868-874.

Aubry, K. B., and D. B. Houston. 1992. Distribution and status of the fisher (Martes Pennanti) in Washington. Northwestern Naturalist, 73, 69-79.

Aubry, K. B., and J. C. Lewis. 2003. Extirpation and reintroduction of fishers (*Martes pennanti*) in Oregon: implications for their conservation in the Pacific states. Biological Conservation, 114, 79-90.

Aubry, K. B., J. C. Lewis, and C. M. Raley. 1996. Reintroduction, current distribution, and ecology of fishers in southwestern Oregon: a progress report : USDA Forest Service Pacific Northwest Research Station.

Beardsley, D., C. Bolsinger, and R. Warbington. 1999. Old-growth forests in the Sierra Nevada: by type in 1945 and 1993 and ownership in 1993 (Research Paper PNW-RP-516). Portland, OR: USDA Forest Service Pacific Northwest Research Station.

Beck, T. W., and G. I. Gould. Jr. 1992. Background and the current management situation for the California spotted owl. In J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., & T. W. Beck (Eds.), The California spotted owl: a technical assessment of its current status (Vol. PSW-GTR-133, pp. 37-54): USDA Forest Service, Pacific Southwest Research Station.

Beckwitt, E. 1990. Petition for a Rule to List the Fisher as Endangered. North San Juan, CA: Central Sierra Audubon Society.

Beesley, D. 1996. Reconstructing the landscape: an environmental history, 1920-1960. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 3-24): University of California, Davis.

Beyer, K. M., and R. T. Golightly. 1996. Distribution of Pacific fisher and other forest carnivores in coastal northwestern California . Arcata, CA: Humboldt State University.

Bias, M. A., and R. J. Gutierrez. 1992. Habitat associations of California spotted owls in the central Sierra Nevada. Journal of Wildlife Management, 56(3), 584-595.

Bolsinger, C. L. 1978. Forest area and timber resources of the San Joaquin area, California (Resource Bulletin RB-PNW-75). Portland: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station.

Bolsinger, C. L., N. McKay, D. R. Gedney, and C. Alerich. 1997. Washington's Public and Private Forests (Resource Bulletin PNW-RB-218): USDA Forest Service Pacific Northwest Research Station.

Bolsinger, C. L., and K. L. Waddell. 1993. Area of Old-Growth Forests in California, Oregon, and Washington (Resource Bulletin PNW-RB-197): USDA Forest Service Pacific Northwest Research Station.

Bombay, H., and D. Lipton. 1994. Biological evaluation of the habitat requirements for fisher on the Eldorado National Forest in relation to twenty-four sold timber sales : USDA Forest Service Eldorado National Forest.

Bouldin, J. 1999. Twentieth-Century Changes in Forests of the Sierra Nevada, California. Unpublished Dissertation, University of California, Davis.

Bowman, J., D. Donovan, and R. C. Rosatte. 2006. Numerical response of fishers to synchronous prey dynamics. Journal of Mammalogy, 87(3),480—484.

Britting, S. A. 2002. Assessment of timber harvest plans within the summer range of California spotted owl in the Sierra Nevada. Unpublished report. Coloma, California. September 10, 2002.

Brook, B. W., D. W. Tonkyn, J. J. O'Grady, and R. Frankham. 2002. Contribution of inbreeding to extinction risk in threatened species. Conservation Ecology 16(1):1-16.

Brown, R. N., M. W. Gabriel, G. Wengert, S. Matthews, J. M. Higley, and J. E. Foley. 2006. Fecally transmitted viruses associated with Pacific fishers (*Martes pennanti*) in northwestern California. Transactions of the Western Section of the Wildlife Society 42:40-46.

Buck, S., C. Mullis, and A. Mossman. 1983. Final Report: Corral Bottom-Hayfork Bally fisher study . Arcata, CA: Humboldt State University and USDA Forest Service.

Buck, S. G., C. Mullis, A. S. Mossman, I. Show, and C. Coolahan. 1994. Habitat use by fishers in adjoining heavily and lightly harvested forest. In S. W. Buskirk, A. S. Harestad, M. G. Raphael, & R. A. Powell (Eds.), Martens, sables and fishers: biology and conservation (pp. 368-376). Ithaca, NY: Cornell University Press.

Buskirk, S. W., and R. A. Powell. 1994. Habitat ecology of American martens and fishers. In S. W. Buskirk, A. S. Harestad, M. G. Raphael, & R. A. Powell (Eds.), Martens, sables and fishers: biology and conservation (pp. 297-315). Ithaca, NY: Cornell University Press.

Byford, K., E. Greenquist, R. Larson, W. Logan, J. Millman, B. Otani, and D. Pengeroth. 1998. Habitat Modification: Biological Assessment for Effects to Listed Species (Habitat Modification): The Willamette Province.

Campbell, L.A. 2004. Distribution and habitat associations of mammalian carnivores in the central and southern Sierra Nevada. PhD Dissertation, University of California, Davis.

Campbell, L. A., W. J. Zielinski, and D. C. Macfarlane. 2000. A risk assessment for four forest carnivores in the Sierra Nevada under proposed forest service management activities (Unpublished Report): USDA Forest Service Sierra Nevada Framework Project.

Carlton, J. 1994. Petition to list the fisher as an endangered species in the western United States: Biodiversity Legal Foundation.

Carroll, C., W. J. Zielinski, and R. F. Noss. 1999. Using presence-absence data to build and spatial habitat models for the fisher in the Klamath Region, U.S.A. Conservation Biology, 13(6), 1344-1359.

Covington, W. W., and M. M. Moore. 1994. Southwestern ponderosa forest structure: changes since Euro-American settlement. Journal of Forestry, 92, 39-47.

Dark, S. J. 1997. A landscape-scale analysis of mammalian carnivore distribution and habitat use by fisher. Unpublished Masters Thesis, Humboldt State University, Arcata, CA.

Drew, R. E., J. G. Hallett, K. B. Aubry, K. W. Cullings, S. M. Koepf, and W. J. Zielinski. 2003. Conservation genetics of the fisher (*Martes pennanti*) based on mitochondrial DNA sequencing. Molecular Ecology, 12, 51-62.

Duane, T. P. 1996a. Human Settlement 1850-2040. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 235-360): University of California, Davis.

Duane, T. P. 1996b. Recreation in the Sierra. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 557-610): University of California, Davis.

FEMAT. 1993. Forest Ecosystem management: An Ecological, Economic, and Social Assessment (Report of the Forest Ecosystem Management Assessment Team).

Folliard, L. (1997). Discovery of an accidental trap for Pacific fishers. The Marten: newsletter of the California North Coast Chapter of The Wildlife Society 2(2): 7.

Franklin, J. F. 1996. Working Group on Late-Successional Conservation Strategies. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, Addendum, Assessments and Scientific Basis for Management Options. : University of California, Davis.

Franklin, J. F., and C. T. Dyrness. 1988. Natural Vegetation of Oregon and Washington: Oregon State University Press.

Franklin, J. F., and J. A. Fites-Kaufmann. 1996. Assessment of late-successional forests of the Sierra Nevada. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 627-662): University of California, Davis.

Freel, M. 1991. A literature review for management of the marten and fisher on National Forests in California : USDA Forest Service Pacific Southwest Region.

Frost, H. C., W. B. Krohn, and C. R. Wallace. 1997. Age-specific reproductive characteristics in fishers. Journal of Mammalogy, 78(2), 598-612.

Goldman, F. A. 1935. New American mustelids of the genera Martes, Gulo, and Lutra. Paper presented at the Proceedings Biological Society of Washington, 48.

Golightly, R. T., T. F. Penland, W. J. Zielinski, and J. M. Higley. 2006. Fisher diet in the Klamath/North Coast Bioregion. Final Report to U.S. Fish and Wildlife Service and Scotia Pacific. Humboldt State Sponsored Programs Foundation, Arcata, California.

Greenwald, D. N., B. Schneider, and J. Carlton. 2000. Petition to list the fisher (*Martes pennanti*) as an endangered species in its West Coast range. November 2000.

Greenwald, D. N. and C. Thomas. 2004. An Updated Petition to List the California Spotted Owl (Strix occidentalis occidentalis) as a threatened or endangered species. Center for Biological Diversity and Sierra Nevada Forest Protection Campaign. August 2004.

Grenfell, W. E., and M. Fasenfest. 1979. Winter food habits of fishers, Martes pennanti, in northwestern California. California Fish and Game, 65, 186-189.

Grinnell, J., J. S. Dixon, and J. M. Linsdale. 1937. Fur-bearing mammals of California. Berkeley, CA: University of California Press.

Hagmeir, E. M. 1959. A re-evaluation of the subspecies of fisher. Canadian Field-Naturalist, 73, 185-197.

Hanski, I., and A. Moilanen. 1996. Minimum Viable Metapopulation Size. The American Naturalist, 147(4), 527-540.

Higley, J. M. 1998. Hoopa Valley Indian Reservation fisher study (Progress report): Hoopa Valley Tribe.

Higley, J. M. and S. Matthews. 2006. Demographic rates and denning ecology of female Pacific fishers (*Martes pennanti*) in northwestern California: Preliminary Report. Hoopa Valley Tribe and Wildlife Conservation Society, Hoopa, California.

Hoopa demographic monitoring report. Undated. Thoughts on demographic monitoring of fisher in the range of the Northern California population.

Hunter, J. E. and M. L. Bond. 2001. Residual trees: wildlife associations and recommendations. Wildlife Society Bulletin 29:995-999.

Jones, J. L., and E. O. Garton. 1994. Selection of successional stages by fishers in north-central Idaho. In S. W. Buskirk, A. S. Harestad, M. G. Raphael, & R. A. Powell (Eds.), Martens, sables and fishers: biology and conservation (pp. 377-388). Ithaca, NY: Cornell University Press.

Kelly, G. M. 1977. Fisher (*Martes pennanti*) biology in the White Mountain National Forest and adjacent areas. University of Massachusetts, Amherst, MA.

Kilgore, B. M., and D. Taylor. 1979. Fire history of a sequoia-mixed conifer forest. Ecology, 60(1), 129-142.

Klug, R. R. 1997. Occurrence of Pacific fisher (Martes pennanti) in the Redwood Zone of northern California and the habitat attributes associated with their detections. Unpublished Master's thesis, Humboldt State University, Arcata, CA.

Krohn, W. B., S. M. Arthur, and T. F. Paragi. 1994. Mortality and vulnerability of a heavily trapped fisher population. In S. W. Buskirk, A. S. Harestad, M. G. Raphael, & R. A. Powell (Eds.), Martens, sables and fishers: biology and conservation (pp. 137-146). Ithaca, NY: Cornell University Press.

Krohn, W. B., W. J. Zielinski, and R. B. Boone. 1997. Relationships among fishers, snow, and martens in California: results from small-scale spatial comparisons. In G. Proulx, H. N. Bryant, & P. M. Woodard (Eds.), Martes: taxonomy, ecology, techniques, and mangement (pp. 211-232). Edmonton, Alberta, Canada: Provincial Museum of Alberta.

Lamberson, R. H., R. L. Truex, W. J. Zielinski, and D. MacFarlane. 2000. Preliminary analysis of fisher population viability in the southern Sierra Nevada. Arcata, CA: Humboldt State University.

Lande, R. 1993. Risks of population extinction from demographic and environmental stochasticity and random catastrophes. American Naturalist, 142, 911-927.

Lande, R., and G. F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. In M. E. Soule (Ed.), Viable populations for conservation (pp. 87-123). Cambridge: Cambridge University Press.

Leiberg, J. B. 1902. Forest conditions in the northern Sierra Nevada, California (Professional Paper No. 8, Series H, Forestry, 5). Washington, D.C.: Department of the Interior, United States Geological Survey.

Leonard, R. D. 1986. Aspects of reproduction of the fisher, Martes pennanti, in Manitoba. The Canadian Field-Naturalist, 100, 32-44.

Lewis, J. C., and D. W. Stinson. 1998. Washington State status report for the fisher. Olympia, WA: Washington Department of Fish and Wildlife.

Lewis, J. C., and W. J. Zielinski. 1996. Historical harvest and incidental capture of fishers in California. Northwest Science, 70(4), 291-297.

MacLean, C. D. 1990. Changes in Area and Ownership of Timberland in Western Oregon: 1961-86 (Resource Bulletin PNW-RB-170): USDA Forest Service Pacific Northwest Research Station.

MacLean, C. D., P. M. Bassett, and G. Yeary. 1992. Timber Resource Statistics for Western Washington (Resource Bulletin PNW-RB-191): USDA Forest Sercive Pacific Northwest Research Station.

Martin, S. K. 1994. Feeding ecology of American martens and fishers. In S. W. Buskirk, A. S. Harestad, M. G. Raphael, & R. A. Powell (Eds.), Martens, sables and fishers: biology and conservation (pp. 297-315). Ithaca, NY: Cornell University Press.

Mazzoni, A. K. 2002. Habitat use by fishers (*Martes pennanti*) in the southern Sierra Nevada, California. Unpublished MS thesis, California State University, Fresno, CA.

McBride, J. R., W. Russell, and S. Kloss. 1996. Impact of human settlement on forest composition and structure. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 1193-1202): University of California, Davis.

McKay, N., P. M. Bassett, and C. D. MacLean. 1995. Timber Resource Statistics for Eastern Washington (Resource Bulletin PNW-RB-201): USDA Forest Service Pacific Northwest Research Station.

McKelvey, K. S., and J. D. Johnston. 1992. Historical perspectives on forests of the Sierra Nevada and the Transverse Ranges of southern California: forest condition at the turn of the century. In J. Verner, K. S.

McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., & T. W. Beck (Eds.), The California spotted owl: a technical assessment of its current status (Vol. General Technical Report, PSW-GTR-133, pp. 225-246): USDA Forest Service, Pacific Southwest Research Station.

Morrison, P. H., D. Kloepfer, D. A. Leversee, C. M. Socha, and D. L. Ferber. 1991. Ancient forests in the Pacific Northwest: analysis and maps of twelve national forests. Washington, D.C.: The Wildernes Society

Nauman, R. S. and D. A. DellaSala. 2007. Scientific evaluation of the BLM's Western Oregon Plan Revisions (WOPR) Impacts on Forests and Watersheds. National Center for Conservation Science & Policy. September 4, 2007.

Nichol, N. M. 2006. Draft status assessment of the Pacific fisher (*Martes pennanti*) in California. California Department of Fish and Game.

Ohmann, J. L., W. C. McComb, and Z. Abdel A. 1994. Snag abundance for primary cavity-nestingbirds on nonfederal forest lands in Oregon and Washington. Wildlife Society Bulletin, 22, 607-620.

Pacific Lumber Company 1999. Habitat Conservation Plan: The Pacific Lumber Company, Scotia Pacific Holding Company and Salmon Creek Corporation.

Pimm, S.L., H.L. Jones, and J. Diamond. 1988. On the risk of extinction. The American Naturalist, 132, 757-785.

Philippa, J. D. W., R. A. Leighton, P.Y. Daoust, O. Nielsen, M. Pagliarulo, H. Schwantje, T. Shury, R. Van Herwijnen, B. E. E. Martina, T. Kuiken, M.W.G. Van de Bildt and A.D.M.E. Osterhaus. 2004. Antibodies to selected pathogens in free-ranging terrestrial carnivores and marine mammals in Canada. Veterinary Record 155:135-140.

Powell, R. A. 1979. Fishers, population models and trapping. Wildlife Society Bulletin, 7, 149-154.

Powell, R. A. 1993. The fisher: life history, ecology and behavior. (Second ed.). Minneapolis: University of Minnesota Press.

Powell, R. A., and W. J. Zielinski. 1994. Fisher. In L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, L. J. Lyon, & W. J. Zielinski (Eds.), The scientific basis for conserving forest carnivores—American marten, fisher, lynx, and wolverine—in the western United States (pp. 38-73). Fort Collins, CO: USDA Forest Service Rocky Mountain Forest and Range Experiment Station.

Quigley, T. M., and S. J. Arbelbide. 1997. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins (General Technical Report PNW-GTR-405): USDA Forest Service Pacific Northwest Research Station.

Raine, R. M. 1987. Winter food habits and foraging behaviour of fishers (*Martes pennanti*) and martens (Martes americana) in southeastern Manitoba. Canadian Journal of Zoology, 65, 745-747.

Rosenberg, K. V., and M. G. Raphael. 1986. Effects of forest fragmentation on vertebrates in Douglas-fir forests. In J. Verner, M. L. Morrison, & C. J. Ralph (Eds.), Wildlife 2000: modeling habitat relationships of terrestrial vertebrates (pp. 263-272). Madison, WI: University of Wisconsin Press.

Schaffer, M. L. 1987. Minimum viable populations: coping with uncertainty. In M. E. Soule (Ed.), Viable populations for conservation (pp. 69-86). Cambridge: Cambridge University Press.

Self, S. and R. Callas. 2006. Pacific fisher natal and maternal den study: Progress Report No. 1, California Department of Fish and Game.

Seglund, A. E. 1995. The use of resting sites by the Pacific fisher. Unpublished Masters Thesis, Humboldt State University, Arcata, CA.

Simpson Timber Company. 1992. Habitat Conservation Plan for the Northern Spotted Owl on the California Timberlands of Simpson Timber Company: Simpson Timber Company and Regional Environmental Consultants.

Sorini-Wilson, K. A. 1997. Horsethief furbearer management plan : USDA Sierra National Forest.

Sprague, L. 1998. Questionnaire from the Regional Forester to Sierra Nevada National Forests, concerning furbearer networks .

Stygar, P. J. 1995. Browns Meadow furbearer management plan . Madera County, California: USDA

National Forest.

Sudworth, G. B. 1900. Stanislaus and Lake Tahoe Forest Reserves, California and Adjacent Territory (Twenty-first annual report to the Secretary of the Interior Part V—Forest Reserves). Washington, D.C.: United States Geological Survey.

Swetnam, T. W., and C. H. Baisan. 1994. Historical fire regime patterns in the Southwestern United States since AD 1700. Paper presented at the Fire effects in Southwestern forests: proceedings of the second La Mesa Fire symposium. USDA Forest Service Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-GTR-286, Los Alamos, New Mexico,

Swetnam, T. W., C. H. Baisan, K. Morino, and A. C. Caprio. 2000. Fire history along an elevational transects in the Sierra Nevada, California (Final Report): Sierra Nevada Global Change Research Program, USGS Biological Resources Division, Sequoia. Kings Canyon and Yosemite National Parks.

Thomas, J. W., E. D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl . Portland, OR: Interagency Scientific Committee to address the conservation of the northern spotted owl.

Tribal-Forestry. 1994. Hoopa Vally Indian Reservation Forest Management Plan for the period 1994-2003 (Forest Management Plan): Hoopa Valley Indian Reservation.

Truex, R. L., W. J. Zielinski, R. T. Golightly, R. L. Barrett, and S. M. Wisely. 1998. A meta-analysis of regional variation in fisher morphology, demography, and habitat ecology in California (Draft Report). Arcata, CA: USDA Forest Service Pacific Southwest Forest and Range Experiment Station.

Truex, R.L. and W. J. Zielinski. 2005. Short-term effects of fire and fire surrogate treatments on fisher habitat in the Sierra Nevada. Final Report. Joint Fire Science Program, 1 August 2005.

USDA Tahoe National Forest. 1990. Tahoe National Forest Land and Resource Management Plan.

USDA Lassen National Forest. 1993. Lassen National Forest Land and Resource Management Plan.

USDA. 2000. Sierra Nevada Forest Plan Amendment Draft Environmental Impact Statement: USDA Forest Service Pacific Southwest Region.

USDA. 2001. Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement and Record of Decision: USDA Forest Service Pacific Southwest Region.

USDA. 2004. Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement and Record of Decision: USDA Forest Service Pacific Southwest Region.

USDA. 2006. Sierra Nevada Forest Plan Accomplishment Monitoring Report for 2005.

USDA and USDI. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (Final Supplemental Environmental Impact Statement): USDA Forest Service and USDI Bureau of Land Management.

USDI. 1990. Determination of Threatened Status for the Northern Spotted Owl (Federal Register/ Vol. 55, No. 123/ Tuesday, June 26, 1990): USDI Fish and Wildlife Service.

USDI. 2004. 50 CFR Part 17. Endangered and threatened wildlife and plants: 12-month finding for a petition to list the west coast distinct population segment of the fisher (*Martes pennanti*); proposed rule. Federal Register 69:18770-18792

Verner, J., K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., and T. W. Beck. 1992. Assessment of the current status of the California spotted owl, with recommendations for management. In J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., & T. W. Beck (Eds.), The California spotted owl: a technical assessment of its current status (Vol. General Technical Report, PSW-GTR-133, pp. 3-26): USDA Forest Service, Pacific Southwest Research Station.

Waddell, K. L., and P. M. Bassett. 1996. Timber Resource Statistics for the North Coast Resource Area of California, 1994 (Resource Bulletin PNW-RB-214): USDA Forest Service Pacific Northwest Research Station.

Waddell, K. L., and P. M. Bassett. 1997. Timber Resource Statistics for the North Interior Resource Area of California (Resource Bulletin PNW-RB-222): USDA Forest Service Pacific Northwest Research Station.

Weatherspoon, C. P., S. J. Husari, and J. W. van Wagtendonk. 1992. Fire and fuels management in relation to owl habitat in forests of the Sierra Nevada and southern California. In J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., & T. W. Beck (Eds.), The California spotted owl: a technical assessment of its current status (Vol. General Technical Report, PSW-GTR-133, pp. 247-260): USDA Forest Service, Pacific Southwest Research Station.

Weinberg, D. H. and K. A. Paul. 2000. Carnivore survey findings on the Mendocino National Forest. USDI Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, CA.

Weir, R. D. and A. S. Harestad. 2003. Scale-dependent habitat selectivity by fishers in south-central British Columbia. Journal of Wildlife Management 67(1), 73-82.

Weir, R. D., A. S. Harestad, and R. W. Write. 2005. Winter diet of fishers in British Columbia. Northwestern Naturalist, 86, 12-19.

Wisdom, M. J., R. S. Holthausen, B. C. Wales, C. D. Hargis, V. A. Saab, D. C. Lee, W. J. Hann, T. D. Rich, M. M. Rowland, W. J. Murphy, et al. 2000. Sources Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-Scale Trends and Management Implications (General Technical Report PNW-GTR-485): USDA ForestService Pacific Northwest Research Station.

Wisely, S. M., S. W. Buskirk, G. A. Russell, K. B. Aubry, and W. J. Zielinski. 2004. Genetic diversity and structure of the fisher (*Martes pennanti*) in a peninsular and peripheral metapopulation. Journal of Mammology, 85(4), 640-648.

Witmer, G. W., S. K. Martin, and R. D. Sayler. 1998. Forest Carnivore Conservation and Management in the Interior Columbia Basin: Issues and Environmental Correlates (General Technical Report PNW-GTR-420): USDA Forest Service Pacific Northwest Research Station.

York, E. 1996. Fisher population dynamics in north-central Massachusetts. Unpublished MS thesis, University of Massachusetts, Amherst, MA.

Zabel, C. J., G. N. Steger, K. S. McKelvey, G. P. Eberlein, B. R. Noon, and J. Verner. 1992. Home-range size and habitat-use patterns of California spotted owls in the Sierra Nevada. In J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., & T. W. Beck (Eds.), The California spotted owl: a technical assessment of its current status (Vol. General Technical Report, PSW-GTR-133, pp. 149-164): USDA Forest Service, Pacific Southwest Research Station.

Zielinski, W. J. 1999. Microhabitat selection by fishers. Presentation at the Wildlife Society meeting, Austin, Texas.

Zielinski, W. J., T. E. Kucera, and R. H. Barret. 1995. Current Distribution of the fisher, *Martes pennanti*, in California. California Fish and Game, 81(3), 104-112.

Zielinski, W. J., R. L. Truex, C. V. Ogan, and K. Busse. 1997a. Detection surveys for fishers and American martens in California, 1989-1994: summary and interpretations. In G. Proulx, H. N. Bryant, & P. M. Woodard (Eds.), Martes: taxonomy, ecology, and management (pp. 372-392). Edmonton, Alberta, Canada: Provincial Museum of Alberta.

Zielinski, W. J., R. H. Barrett, and R. L. Truex. 1997b. Southern Sierra Nevada fisher and marten study: progress report IV . Arcata, CA: USDA Forest Service Pacific Southwest Research Station.

Zielinski, W. J., N.P. Duncan, E.C. Farmer, R. L. Truex, A.P. Clevenger, and R.H. Barrett. 1999. Diet of fisher (*Martes pennanti*) at the southernmost extent of their range. Journal of Mammalogy, 80(3), 961-971.

Zielinski, W. J., R. L. Truex, L.A. Campbell, C.R. Carroll, and Frederick V. Schlexer. 2000. Systematic surveys as a basis for the conservation of carnivores in California forests, progress report II: 1996-1999. USDA Forest Service, Pacific Southwest Research Station, Redwood Sciences Laboratory, Arcata, CA.

Zielinski, W. J. and N. P. Duncan. 2004. Diets of sympatric populations of American martens (Martes americana) and fishers (Martes pennanti) in California. Journal of Mammalogy, 85(3), 470-477

Zielinski, W. J., R. L. Truex, G. A. Schmidt, F. V. Schlexer, K. N. Schmidt, and R. H. Barrett. 2004a. Resting habitat selection by fishers in California. Journal of Wildlife Management 68(3), 475-492.

Zielinski, W. J., R. L. Truex, G. A. Schmidt, F. V. Schlexer, K. N. Schmidt, and R. H. Barrett. 2004b. Home range characteristics of fishers in California. Journal of Mammology 85(4), 649-657

Zielinski, W. J., R. L. Truex, F. V. Schlexer, L. A. Campbell, and C. Carroll. 2005a. Historical and contemporary distributions of carnivores in forests of the Sierra Nevada, California, USA. Journal of Biogeography, 32:1385-1407.

Zielinski, W. J., J. Werren, and T. Kirk. 2005b. Selecting candidate areas for fisher (*Martes pennanti*) conservation that minimize potential effects on martens (*M. americana*). Unpublished report.

LIST OF ATTACHMENTS

Arthur, S. M., and W. B. Krohn. 1991. Activity patterns, movements, and reproductive ecology of fishers in southcentral Maine. Journal of Mammalogy, 72, 379-385.

Arthur, S. M., W. B. Krohn, and J. B. Gilbert. 1989. Home range characteristics of adult fishers. Journal of Wildlife Management, 53(3), 674-679.

Aubry, K. B., and J. C. Lewis. 2003. Extirpation and reintroduction of fishers (*Martes pennanti*) in Oregon: implications for their conservation in the Pacific states. Biological Conservation, 114, 79-90.

Beardsley, D., C. Bolsinger, and R. Warbington. 1999. Old-growth forests in the Sierra Nevada: by type in 1945 and 1993 and ownership in 1993 (Research Paper PNW-RP-516). Portland, OR: USDA Forest Service Pacific Northwest Research Station.

Beesley, D. 1996. Reconstructing the landscape: an environmental history, 1920-1960. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 3-24): University of California, Davis.

Bowman, J., D. Donovan, and R. C. Rosatte. 2006. Numerical response of fishers to synchronous prey dynamics. Journal of Mammalogy, 87(3),480—484.

Bolsinger, C. L., and K. L. Waddell. 1993. Area of Old-Growth Forests in California, Oregon, and Washington (Resource Bulletin PNW-RB-197): USDA Forest Service Pacific Northwest Research Station.

Bouldin, J. 1999. Twentieth-Century Changes in Forests of the Sierra Nevada, California. Unpublished Dissertation, University of California, Davis.

Britting, S. A. 2002. Assessment of timber harvest plans within the summer range of California spotted owl in the Sierra Nevada. Unpublished report. Coloma, California. September 10, 2002.

Brook, B. W., D. W. Tonkyn, J. J. O'Grady, and R. Frankham. 2002. Contribution of inbreeding to extinction risk in threatened species. Conservation Ecology 16(1):1-16.

Brown, R. N., M. W. Gabriel, G. Wengert, S. Matthews, J. M. Higley, and J. E. Foley. 2006. Fecally transmitted viruses associated with Pacific fishers (*Martes pennanti*) in northwestern California. Transactions of the Western Section of the Wildlife Society 42:40-46.

Buck, S., C. Mullis, and A. Mossman. 1983. Final Report: Corral Bottom-Hayfork Bally fisher study . Arcata, CA: Humboldt State University and USDA Forest Service.

Campbell, L.A. 2004. Distribution and habitat associations of mammalian carnivores in the central and southern Sierra Nevada. PhD Dissertation, University of California, Davis.

Campbell, L. A., W. J. Zielinski, and D. C. Macfarlane. 2000. A risk assessment for four forest carnivores in the Sierra Nevada under proposed forest service management activities (Unpublished Report): USDA Forest Service Sierra Nevada Framework Project.

Carroll, C., W. J. Zielinski, and R. F. Noss. 1999. Using presence-absence data to build and spatial habitat models for the fisher in the Klamath Region, U.S.A. Conservation Biology, 13(6), 1344-1359.

Drew, R. E., J. G. Hallett, K. B. Aubry, K. W. Cullings, S. M. Koepf, and W. J. Zielinski. 2003. Conservation genetics of the fisher (*Martes pennanti*) based on mitochondrial DNA sequencing. Molecular Ecology, 12, 51-62.

Duane, T. P. 1996a. Human Settlement 1850-2040. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 235-360): University of California, Davis.

Duane, T. P. 1996b. Recreation in the Sierra. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 557-610): University of California, Davis.

Franklin, J. F., and J. A. Fites-Kaufmann. 1996. Assessment of late-successional forests of the Sierra Nevada. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 627-662): University of California, Davis.

Freel, M. 1991. A literature review for management of the marten and fisher on National Forests in California : USDA Forest Service Pacific Southwest Region.

Frost, H. C., W. B. Krohn, and C. R. Wallace. 1997. Age-specific reproductive characteristics in fishers. Journal of Mammalogy, 78(2), 598-612.

Golightly, R. T., T. F. Penland, W. J. Zielinski, and J. M. Higley. 2006. Fisher diet in the Klamath/North Coast Bioregion. Final Report to U.S. Fish and Wildlife Service and Scotia Pacific. Humboldt State Sponsored Programs Foundation, Arcata, California.

Hanski, I., and A. Moilanen. 1996. Minimum Viable Metapopulation Size. The American Naturalist, 147(4), 527-540.

Hoopa demographic monitoring report. Undated. Thoughts on demographic monitoring of fisher in the range of the Northern California population

Lamberson, R. H., R. L. Truex, W. J. Zielinski, and D. MacFarlane. 2000. Preliminary analysis of fisher population viability in the southern Sierra Nevada. Arcata, CA: Humboldt State University.

Lande, R. 1993. Risks of population extinction from demographic and environmental stochasticity and random catastrophes. American Naturalist, 142, 911-927.

Lewis, J. C., and W. J. Zielinski. 1996. Historical harvest and incidental capture of fishers in California. Northwest Science, 70(4), 291-297.

Mazzoni, A. K. 2002. Habitat use by fishers (*Martes pennanti*) in the southern Sierra Nevada, California. Unpublished MS thesis, California State University, Fresno, CA.

McBride, J. R., W. Russell, and S. Kloss. 1996. Impact of human settlement on forest composition and structure. In W. R. Center (Ed.), Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II, Assessments and Scientific Basis for Management Options. (pp. 1193-1202): University of California, Davis.

McKelvey, K. S., and J. D. Johnston. 1992. Historical perspectives on forests of the Sierra Nevada and the Transverse Ranges of southern California: forest condition at the turn of the century. In J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., & T. W. Beck (Eds.), The California spotted owl: a technical assessment of its current status (Vol. General Technical Report, PSW-GTR-133, pp. 225-246): USDA Forest Service, Pacific Southwest Research Station.

Nichol, N. M. 2006. Draft status assessment of the Pacific fisher (*Martes pennanti*) in California. California Department of Fish and Game.

Philippa, J. D. W., R. A. Leighton, P.Y. Daoust, O. Nielsen, M. Pagliarulo, H. Schwantje, T. Shury, R. Van Herwijnen, B. E. E. Martina, T. Kuiken, M.W.G. Van de Bildt and A.D.M.E. Osterhaus. 2004. Antibodies to selected pathogens in free-ranging terrestrial carnivores and marine mammals in Canada. Veterinary Record 155:135-140.

Pimm, S.L., H.L. Jones, and J. Diamond. 1988. On the risk of extinction. The American Naturalist, 132, 757-785.

Powell, R. A. 1979. Fishers, population models and trapping. Wildlife Society Bulletin, 7, 149-154.

Powell, R. A., and W. J. Zielinski. 1994. Fisher. In L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, L. J. Lyon, & W. J. Zielinski (Eds.), The scientific basis for conserving forest carnivores—American marten, fisher, lynx, and wolverine—in the western United States (pp. 38-73). Fort Collins, CO: USDA Forest Service Rocky Mountain Forest and Range Experiment Station.

Spencer, W., H. Rustigian, R. Scheller, and J. Strittholt. 2007. Baseline evaluation of fisher habitat and population status in the southern Sierra Nevada. Final Report to Region 5, USDA Forest Service.

Truex, R. L., W. J. Zielinski, R. T. Golightly, R. L. Barrett, and S. M. Wisely. 1998. A meta-analysis of regional variation in fisher morphology, demography, and habitat ecology in California (Draft Report). Arcata, CA: USDA Forest Service Pacific Southwest Forest and Range Experiment Station.

Truex, R.L. and W. J. Zielinski. 2005. Short-term effects of fire and fire surrogate treatments on fisher habitat in the Sierra Nevada. Final Report. Joint Fire Science Program, 1 August 2005.

Verner, J., K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., and T. W. Beck. 1992. Assessment of the current status of the California spotted owl, with recommendations for management. In J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., & T. W. Beck (Eds.), The California spotted owl: a technical assessment of its current status (Vol. General Technical Report, PSW-GTR-133, pp. 3-26): USDA Forest Service, Pacific Southwest Research Station.

Waddell, K. L., and P. M. Bassett. 1996. Timber Resource Statistics for the North Coast Resource Area of California, 1994 (Resource Bulletin PNW-RB-214): USDA Forest Service Pacific Northwest Research Station.

Weatherspoon, C. P., S. J. Husari, and J. W. van Wagtendonk. 1992. Fire and fuels management in relation to owl habitat in forests of the Sierra Nevada and southern California. In J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutierrez, G. I. G. Jr., & T. W. Beck (Eds.), The California spotted owl: a technical assessment of its current status (Vol. General Technical Report, PSW-GTR-133, pp. 247-260): USDA Forest Service, Pacific Southwest Research Station.

Weinberg, D. H. and K. A. Paul. 2000. Carnivore survey findings on the Mendocino National Forest. USDI Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, CA

Weir, R. D., A. S. Harestad, and R. W. Write. 2005. Winter diet of fishers in British Columbia. Northwestern Naturalist, 86, 12-19.

Wisely, S. M., S. W. Buskirk, G. A. Russell, K. B. Aubry, and W. J. Zielinski. 2004. Genetic diversity and structure of the fisher (*Martes pennanti*) in a peninsular and peripheral metapopulation. Journal of Mammology, 85(4), 640-648.

Zielinski, W. J., T. E. Kucera, and R. H. Barret. 1995a. Current Distribution of the fisher, *Martes pennanti*, in California. California Fish and Game, 81(3), 104-112.

Zielinski, W. J., N.P. Duncan, E.C. Farmer, R. L. Truex, A.P. Clevenger, and R.H. Barrett. 1999. Diet of fisher (*Martes pennanti*) at the southernmost extent of their range. Journal of Mammalogy, 80(3), 961-971.

Zielinski, W. J. and N. P. Duncan. 2004. Diets of sympatric populations of American martens (Martes americana) and fishers (Martes pennanti) in California. Journal of Mammalogy, 85(3), 470-477

Zielinski, W. J., R. L. Truex, G. A. Schmidt, F. V. Schlexer, K. N. Schmidt, and R. H. Barrett. 2004a. Resting habitat selection by fishers in California. Journal of Wildlife Management 68(3), 475-492.

Zielinski, W. J., R. L. Truex, G. A. Schmidt, F. V. Schlexer, K. N. Schmidt, and R. H. Barrett. 2004b. Home range characteristics of fishers in California. Journal of Mammology 85(4), 649-657

Zielinski, W. J., R. L. Truex, F. V. Schlexer, L. A. Campbell, and C. Carroll. 2005a. Historical and contemporary distributions of carnivores in forests of the Sierra Nevada, California, USA. Journal of Biogeography, 32:1385-1407.

Zielinski, W. J., J. Werren, and T. Kirk. 2005b. Selecting candidate areas for fisher (*Martes pennanti*) conservation that minimize potential effects on martens (*M. americana*). Unpublished report.