PETITION TO THE STATE OF CALIFORNIA FISH AND GAME COMMISSION TO LIST THE BLACK-BACKED WOODPECKER (*PICOIDES ARCTICUS*) AS THREATENED OR ENDANGERED UNDER THE CALIFORNIA ENDANGERED SPECIES ACT

The Black-backed Woodpecker **(*Picoides arcticus*)**

Photo by Doug Bevington

Notice of Petition

The John Muir Project of Earth Island Institute and the Center for Biological Diversity submit this petition to the California Fish and Game Commission to list the black-backed woodpecker (*Picoides arcticus*) as “endangered”, or alternatively, “threatened,” in California, under the California Endangered Species Act (California Fish and Game Code §§ 2050 *et seq.*, “CESA”). This petition demonstrates that the black-backed woodpecker clearly warrants listing under CESA based on the factors specified in the statute. We look forward to the Commission’s response to this petition and processing of it pursuant to the procedures and timelines established at California Fish and Game Code §§ 2073 *et seq.*

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EXECUTIVE SUMMARY

"*I believe it would be difficult to find a forest-bird species more restricted to a single vegetation cover type… than the Black-backed Woodpecker is to early post-fire conditions…*"

Dr. Richard Hutto (1995 at p. 1050)

"*The dramatic positive response of so many plant and animal species to severe fire and the absence of such responses to low-severity fire in conifer forests throughout the US West argue strongly against the idea that severe fires are unnatural. The biological uniqueness associated with severe fires could emerge only from a long evolutionary history between a severe-fire environment and the organisms that have become relatively restricted in distribution to such fires. The retention of those unique qualities associated with severely burned forest should, therefore, be of highest importance in management circles.*"

Dr. Richard Hutto (2006 at p. 987)

"It is clear from our first year of monitoring three burned areas that post-fire habitat, especially high severity areas, are an important component of the Sierra Nevada ecosystem…post-fire areas are not black slates or catastrophic wastelands; they are a unique component of the ecosystem that supports a diverse and abundant avian community…"

U.S. Forest Plumas Lassen Study 2009 Annual Report, pp. 9-41 (research conducted by PRBO Conservation Science; report available at www.fs.fed.us/psw/programs/snrc/)

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An intensely[1] burned forest of dense, fire-killed trees (snags) is perhaps the most maligned, misunderstood, and imperiled habitat type in California. The public's perception of a snag forest is one of devastation, when actually it is an ecological treasure trove. Thousands of native beetles burrow into and lay their eggs inside the blackened trees, which in turn attracts large numbers of insect-feeding birds. Some birds drill holes in the trees to create nesting cavities, and when they are finished, other birds and even mammals will use the holes for nesting, too. Large fallen logs shelter woodrats, mice, and voles that feast on the seeds of regenerating shrubs, while mule deer browse on the shrubs' fresh leaves. Hawks and owls hunt for prey. Far from being "dead," a snag forest harbors extraordinarily rich biological diversity.

For the past half-century, Smokey the Bear has implored us to prevent fires before they "destroy" forest and kill animals. The U.S. Forest Service has been given *carte blanche* to suppress nearly every fire on our public forest lands, regardless of where it starts and

[1] In this petition, we use the term "fire intensity", or "high-intensity" fire, rather than "fire severity" or "high-severity" fire because the term "severity" has a negative, pejorative connotation that is not consistent with the current state of ecological knowledge in fire ecology. Thus, we chose to use the more value-neutral term "intensity".

how it burns, and the agency has been doing so quite effectively for decades. Moreover, the Forest Service and timber companies promptly cut trees that do burn to capitalize on their economic value, justifying their actions on the erroneous assertion that these trees have no ecological value. The result is a disturbing scarcity of unlogged, intensely burned, snag forest habitat, and the loss of the tremendous biological diversity it supports.

In recent years, mounting scientific evidence regarding the importance of fire to the health of the forest has led the Forest Service and the public to accept low-intensity burning in order to lower "fuel loading," with the biggest benefit seen as a reduction in future high-intensity fires. However, scientific data show that high-intensity fires are not only natural in our forests, but create critically important habitat for a wide variety of species. Government agencies, politicians, and the media have not kept pace with this science, and to this day refuse to recognize the ecological benefits of high-intensity fire and the subsequent snag forest habitat it creates. This refusal has led to the inevitable decline and imperilment of the black-backed woodpecker (*Picoides arcticus*) in California.

No other vertebrate species so exemplifies a burned-forest specialist like the black-backed woodpecker. Black-backed woodpeckers are one of the most specialized birds for digging out wood-boring beetle larvae from fire-killed trees. *P. arcticus* is a "keystone species" in intensely burned snag forests, acting as an important primary excavator that provides nesting holes for itself and other cavity-nesting birds and mammals. They also are one of the most highly selective bird species not only with respect to using burned or otherwise naturally disturbed forests, but also targeting specific large nesting and foraging snags within a stand – their optimal habitat is dense, mature and old-growth conifer forest that has been intensely burned and protected from salvage-logging. But black-backed woodpeckers can only effectively use a snag forest for several years after it is created – thus, they depend upon the future occurrence of high-intensity fire to constantly replenish their habitat. Unfortunately, due to lack of habitat protection, black-backeds in California were once described as "numerous" but are now considered "rare," and their habitat has shrunk to a fraction of what it once was. Based on analysis of currently suitable habitat and woodpecker density estimates using the best available scientific data, we approximate an extant population of only 161 to 300 pairs of black-backed woodpeckers in California.

Historical and current post-fire salvage logging is unequivocally the greatest threat facing the black-backed woodpecker in California. The U.S. Forest Service and California Department of Forestry and Fire Protection have failed completely to provide any regulatory protection for severely burned snag forests on private and public lands. Intensely burned snag forest habitat not only has no legal protection, but the *modus operandi* on private and public lands is to actively eliminate it. Moreover, widespread fire suppression and fire prevention projects aimed at decreasing fuel loads reduce the potential for new optimal black-backed habitat to be created. Finally, fire-prevention projects that lower the density of large trees also degrade the older unburned forests required by the black-backed woodpecker for persistence when burned forest is temporarily unavailable. The great majority of the suitable black-backed woodpecker habitat that is created occurs outside of Wilderness Areas and National Parks—i.e., in areas where it is open to elimination through post-fire salvage logging on public and private lands.

The John Muir Project and the Center for Biological Diversity submit this petition to list the California population of the black-backed woodpecker 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 black-backed woodpecker in California has experienced consistent, systematic, long-term elimination and degradation of the burned-forest habitat upon which it depends for survival, and that current regulatory and statutory provisions are profoundly inadequate to protect this species. The loss of habitat has reduced the population in California from numerous to rare. Without a continuous supply of intensely burned forest comprised of densely packed, large fire-killed trees, and the protection of such snag forests when they are created, the black-backed woodpecker in California simply will not survive.

THE CESA LISTING PROCESS AND STANDARDS FOR THE ACCEPTANCE OF A PETITION

Recognizing that certain species of plants and animals have become extinct "as a consequence of man's activities, untempered by adequate concern for conservation," (Fish and Game Code § 2051 (a)); that other species are in danger of, or threatened with, extinction because their habitats are threatened with destruction, adverse modification, or severe curtailment, or because of overexploitation, disease, predation, or other factors (Fish and Game Code § 2051 (b)); and that "[t]hese species of fish, wildlife, and plants are of ecological, educational, historical, recreational, esthetic, economic, and scientific value to the people of this state, and the conservation, protection, and enhancement of these species and their habitat is of statewide concern." (Fish and Game Code § 2051 (c)) the California Legislature enacted the California Endangered Species Act ("CESA").

The purpose of CESA is to "conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat...." (Fish and Game Code § 2052). To this end, CESA provides for the listing of species as "threatened[1]" and "endangered[2]." The California Fish and Game Commission ("Commission") is the administrative body that makes all final CESA listing decisions, while the California Department of Fish and Game ("Department") is the expert agency that makes recommendations as to which species warrant CESA listing. The listing process may be set in motion either when "any person" petitions the Commission to list a species, or when the Department on its own initiative submits a species for consideration. In the case of a citizen proposal, CESA sets forth a process for listing that contains several discrete steps.

Upon receipt of a petition to list a species, a 90-day review period ensues during which the Commission refers the petition to the Department, as the relevant expert agency, to prepare a detailed report. The Department's report must determine whether the petition, along with other relevant information possessed or received by the Department, contains sufficient information indicating that listing may be warranted (Fish and Game Code § 2073.5). During this period interested persons are notified of the petition and public comments are accepted by the Commission (Fish and Game Code § 2073.3). After receipt of the Department's report, the Commission considers the petition at a public hearing (Fish and Game Code § 2074). At this time the Commission is charged with its first substantive decision, to determine whether the petition, together with the Department's written report, and comments and testimony received, present sufficient information to indicate that listing of the species "may be warranted," (Fish and Game

[1]"Threatened species" means a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by this chapter (Fish and Game Code § 2067).

[2]"Endangered species" means a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease (Fish and Game Code § 2062).

Code § 2074.2). This standard has been interpreted by the courts as the amount of information sufficient to "lead a reasonable person to conclude there is a substantial possibility the requested listing could occur." *Natural Resources Defense Council v. California Fish and Game Comm*. 28 Cal.App.4th at 1125, 1129. If the petition, together with the Department's report and comments received, indicates that listing "may be warranted," then the Commission must accept the petition and designate the species as a "candidate species[3]" (Fish and Game Code § 2074.2).

Once the petition is accepted by the Commission, a more detailed level of review begins. The Department is given 12 months from the date of the acceptance of the petition to complete a full status review of the species and recommend whether such listing "is warranted." Following receipt of the Department's status review, the Commission holds an additional public hearing and determines whether listing of the species "is warranted." If the Commission finds that the species is faced with extinction throughout all or a significant portion of its range, it must list the species as endangered (Fish and Game Code § 2062). If the Commission finds that the species is likely to become an endangered species in the foreseeable future, it must list the species as threatened (Fish and Game Code § 2067).

Notwithstanding these listing procedures, the Commission may adopt a regulation that adds a species to the list of threatened or endangered species at any time if the Commission finds that there is any emergency posing a significant threat to the continued existence of the species (Fish and Game Code § 2076.5).

The California Endangered Species Act is modeled after the federal Endangered Species Act, 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. Fish and Game Code § 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."

[3]"Candidate species" means a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that the Commission has formally noticed as being under review by the Department for addition to either the list of endangered species or the list of threatened species, or a species for which the Commission has published a notice of proposed regulation to add the species to either list (Fish & Game Code § 2068).

LIFE HISTORY OF THE BLACK-BACKED WOODPECKER

I. DESCRIPTION

Appearance—The black-backed woodpecker (*Picoides arcticus*) is a towhee- to robin-sized three-toed woodpecker inhabiting montane and boreal conifer forests of North America. *P. arcticus* is heavily barred black and white on the sides and flanks with nearly solid black upperparts, as compared with *Dryobates*, and has a white throat, as compared with *Sphyrapicus* (Dawson 1923). Males and young sport a yellow crown-patch, while the female crown is entirely black. The bird's sooty black dorsal plumage serves to camouflage it against the deeply black, charred bark of the burned trees upon which it preferentially forages (Murphy and Lehnhausen 1998, Dixon and Saab 2000). The black-backed woodpecker has only three toes on each foot as part of an adaptive complex, including skull modifications, which makes it among the most specialized of birds for digging out wood-boring insect larvae (Bock and Bock 1974).

Figure 1. Male (left) and female (right) black-backed woodpecker.
Left photo Flickr commons/ Steve Urszenyi; right photo Flickr commons/ Kestrel360.

Adult Male: Glossy blue-black upperparts continuous onto wings, tail, crown, and sides with a few white tips on black rump feathers; duller on flight-feathers; primaries and outer secondaries black with paired spots of white on edges of outer and inner webs (Dawson 1923, Dixon and Saab 2000). Four middle rectrices of tail black, next pair mostly black with distal portion brownish white or pale rusty brown, usually tipped with black; three outermost pairs graduated, mostly white, tinged terminally with brownish (Dixon and Saab 2000) and white on exposed (under) portions (Dawson 1923). A distinct squarish crown-patch of yellow (mustard-yellow, or light cadmium to orange); a transverse white cheek-stripe meeting fellow on forehead and cut off by black malar-stripe from white of throat and remaining underparts; nasal tufts and gular feathers long, covering base of bill (Dawson 1923, Dixon and Saab 2000). Bill plumbeous slaty, the mandible lighter; feet and legs grayish dusky or bluish gray, foot with only three toes, one directed backward and two directed forward; iris reddish brown in juvenile, deep reddish in adult (Dawson 1923, Dixon and Saab 2000).

Adult Female: Like male, but crown entirely black without yellow crown-patch.

Young male: Like adult male, but black of upperparts duller, white of underparts less pure, tinged more or less with dingy gray; barring of sides more blended; the yellow of crown-patch reduced, streaky.

Young female: Like young male, but yellow of crown still further reduced, sometimes barely perceptible.

Males are approximately 6–7% heavier than females; a small sample indicates that adults weigh between 61 and 88 grams (Dixon and Saab 2000). Males have slightly longer wings and tails than females, with bills 5–10% longer. Table 1 shows linear measurements of male and female black-backed woodpecker bill, wing, tail, and tarsus lengths, including average length and range (from Dixon and Saab 2000).

Table 1: Linear measurements (mm) of 39 Adult Male and 34 Adult Female Black-backed Woodpeckers. From Dixon and Saab 2000.

Bill Length	
Male	33.0 (31.0–35.0)
Female	30.7 (28.5–34.5)
Wing Length	
Male	129.5 (125.0–134.0)
Female	126.8 (123.0–133.5)
Tail Length	
Male	77.9 (74.0–85.0)
Female	78.8 (73.5–85.5)
Tarsus Length	
Male	22.9 (21.5–24.0)
Female	22.0 (21.0–23.0)

Methods of Communication—Black-backed woodpecker vocalizations include a ‘kyik’ call note that functions mostly as an alarm-threat or to express excitement, or a contact call between members of a pair (Kilham 1966, Dixon and Saab 2000). It has been described variously as a kyik, chet, chuck, or click sound. This call is a fast, double click that sounds more like a sharp, single click when heard in the field, and is given by both sexes throughout the year (Dixon and Saab 2000). A fast series of kyik calls also accompanies copulation (Dixon and Saab 2000).

One of the more interesting and complex of *Picoides* calls is the black-backed woodpecker’s ‘scream, rattle, and snarl.’ This call is given during agonistic encounters between black-backed woodpeckers as well as with other species; it is also used in establishing territories (Dixon and Saab 2000). A short rattle call, or kyik-ek call, summons the mate for either defending territory or feeding young (Dixon and Saab 2000).

Various 'chirp calls' are given by nestlings during feeding (Kilham 1966, Dixon and Saab 2000). Kilham (1966) noted that nestlings made chittery vocalizations that increased when a parent approached, then diminished after the parent had left. The nestlings also made a steady click-click-click begging note.

Non-vocal methods of communication are evident in black-backed woodpeckers as well, including displays or drumming and tapping with the bill against a tree trunk. Displays include bill-positioning postures, with bill lowering as a threatening posture and bill raising as an indication of fleeing; crest-raising displays, in which males elevate crown feathers in the presence of a female or to threaten another bird; head-swinging or bill-waving, where the head swings in a narrow arc from side to side; and flutter aerial displays, to threaten whereby a mothlike flight with wings held in a spread or downward position dramatizes the presence of a bird (Dixon and Saab 2000). Members of a pair will greet each other by raising their wings horizontally, but when confronting rivals will raise their wings up over their backs in full extension (Kilham 1966). This latter wing-spreading display incorporates crest-raising, bill-lowering, head-swinging, and a scream, rattle, and snarl call. Black-backed woodpeckers will occasionally spread their tail feathers to an opponent, and sometimes directly attack by hopping or flying at an antagonist (Dixon and Saab 2000).

Black-backed woodpeckers will rap or tap their bill against a tree trunk when anxious or just before roosting (Killham 1966). Both males and females drum to broadcast a territory or attract a mate (Dixon and Saab 2000). Black-backed drums are faster in tempo than drums of three-toed woodpeckers (*P. tridactiylus*), and are less variable than drums of three-toed, hairy (*P. villosus*), and Strickland's (*P. stricklandi*) woodpeckers (Dixon and Saab 2000). Females average more beats in a roll than males; morning is the most common time for drumming, but individuals also drum just before sunset (Dixon and Saab 2000). Killham (1966) noted that the two females he observed drummed far more often than their mates.

II. TAXONOMY

The black-backed woodpecker, *Picoides arcticus*, falls within the order Piciformes, Family Picidae, and subfamily Picinae (DeSante and Pyle 1986). Also variously known as the arctic three-toed woodpecker, the black-backed three-toed woodpecker, and the Sierra three-toed woodpecker, the species was first described by Swainson and Richardson in 1832, with the type locality near the sources of the Athabasca River on the eastern declivity of the Rocky Mountains (AOU 1983). The species is most likely to be confused with the closely related three-toed woodpecker, which has similar plumage and some overlapping distribution to the black-backed woodpecker (Bock and Bock 1974). The three-toed woodpecker has variable amounts of white on the back and a broad white stripe below the eye, as opposed to the black-backed woodpecker with uniformly dark upperparts and a thin white stripe below the eye (Dixon and Saab 2000). Three-toed woodpeckers are smaller than black-backed woodpeckers (Bock and Bock 1974). Black-backed woodpeckers also have lower-pitched, shorter, and more metallic call notes with faster bursts and more beats than three-toed woodpeckers (Dixon and Saab 2000).

While three-toed woodpeckers and black-backed woodpeckers are sympatric throughout much of their ranges, three-toed woodpeckers are Holarctic-distributed, ranging across the Palearctic and as far south as Arizona and New Mexico, and thus are more wide-ranging than black-backed woodpeckers, which occur in dense montane forests only as far south as the Black Hills of South Dakota, north-western Wyoming, and the southern/central Sierra Nevada (the southernmost portion of its range). Bock and Bock (1974) concluded that *P. tridactylus* is strongly tied to spruce trees and associated bark beetles, with an affinity for smaller deciduous trees, while the black-backed woodpecker is adapted to dense boreal and montane coniferous forests consisting of larger trees. Both species respond to insect outbreaks following fires, windfall, and large-scale drought- or beetle-induced mortality events. Black-backed woodpeckers probably evolved in North America from an ancestor in common with the three-toed woodpecker, which secondarily invaded the Nearctic from Eurasia via the Bering land bridge (Bock and Bock 1974).

III. REPRODUCTION

Black-backed woodpeckers are primary cavity excavators, whereby individuals create a hole in a selected tree in which to lay and incubate their eggs. Females can lay a second clutch if the first is lost. The species can nest in live or dead trees, but most nests are found in medium-sized dead pines (Dixon and Saab 2000). Breeding black-backeds have been documented in both green (i.e., relatively undisturbed) and black/brown (i.e., recently disturbed) forests, but densities of nesting pairs are greatest in newly burned forests that had high pre-fire canopy closure and contain high densities of medium and large trees (Russell et al. 2007, Hanson and North 2008).

Nest Excavation—Black-backed woodpeckers typically excavate and occupy a new nest cavity every year (Dixon and Saab 2000). Nest excavation usually occurs in April and May, with the completion of excavation ranging from end of May in Michigan to mid-June in Oregon (Dixon and Saab 2000). Both sexes excavate nests, but the male apparently does most of the work, with both excavating intermittently over the course of the day (Dixon and Saab 2000). Raphael and White (1984) report mean dimensions of 8 black-backed woodpecker nests in the northern Sierra Nevada, California: mean nest tree height was 16.8 m and mean nest tree diameter at breast height ("dbh") was 44.5 cm. Mean hole height was 2.8 m (SE = 0.59), mean tree diameter at the hole was 38.3 cm (SE = 3.12), mean minimum diameter of hole entrance was 44.3 mm (SE = 1.53), mean cavity depth was 20.6 cm (SE = 1.46), mean internal diameter of cavity was 11.1 cm (SE = 0.69), and mean sill width was 4.4 cm (SE = 0.71).

Incubation, Brooding, and Parental Care—Eggs are laid approximately the third week of April in Idaho, and mid-May to mid-June in Wisconsin (Dixon and Saab 2000).

Females lay from 2 to 6, but typically 3 or 4, glossy white eggs that measure 21–25 mm in length and 18.2–18.9 mm in breadth (Dixon and Saab 2000). If eggs are destroyed, females will lay a second set of eggs, often in the same nest (Dixon and Saab 2000, Bonnot et al. 2008). Both sexes will incubate eggs, but the female seems to take shorter shifts during the day, and the male always incubates at night (Dixon and Saab 2000). At hatching, young are altricial and naked, but no data area are available on size or mass (Dixon and Saab 2000).

Both sexes also brood the young, with the male brooding at night until late in the nestling phase when young begin to act aggressively (Dixon and Saab 2000). Little brooding is done during the day once young are moderately developed, but adults sometimes remain in the nest to brood for 4–17 minutes at a time (Dixon and Saab 2000). Adults approach the nest cavity from all directions and often glide the last 10 m. The adult will typically turn its head laterally and place its bill perpendicular to and within the bill of its nestlings (Kilham 1966, Dixon and Saab 2000). The nestlings will eat food directly from the parent's bill, but males also have been observed regurgitating food to the young, indicating that food may also be carried in the esophagus (Dixon and Saab 2000). In his observations of two black-backed woodpecker nests, Kilham (1966) found that females feed the young more frequently but carry relatively small amounts of prey with each visit, while males visited less often but with larger or more insects in their bills. Moreover, males performed all or nearly all of the sanitation of the nest. Kilham (1966) also noted extremely aggressive behavior of the nestlings, described as "the almost ferocious energy with which they attacked their surroundings," (p. 309).

In southwestern Idaho, young black-backed woodpeckers typically fledged early June through early July, at about 24 days of age (range 21.5–25.0, *n* = 11 nests; Dixon and Saab 2000). Bull et al. (1986) documented that young fledged from the nest after 6 July at 63% of nests in northeastern Oregon, while in central Oregon young fledged as early as 17 June (Dixon and Saab 2000). Adults often urged the fledglings from the nest cavity (Dixon and Saab 2000), after which each adult would attend 1 or 2 of the fledglings, with the fledglings often switching between the adult male and the adult female as they copied the adults' foraging behaviors (Dixon and Saab 2000).

Nest Success—Nest success of black-backed woodpeckers in heavily burned forests of the Rocky Mountains region was 87% in Idaho, 100% in Wyoming, and 71% in Montana (Dixon and Saab 2000). Vierling et al. (2008) reported overall nest success was >70% in heavily burned forests in the Black Hills, South Dakota, but decreased with each successive year after fire, with 78% successful nests (*n* = 73 nests) 2 years post-fire and decreasing to 73% (*n* = 57 nests) 3 years after fire and 67% (*n* = 9) 4 years after fire. Nest success also varied by burn intensity, with overall reproductive success 80% in high-intensity patches, and only 50% in moderately burned and 60% in low-intensity burned patches. Bonnot et al. (2008) evaluated factors correlated with the nest success of black-backed woodpeckers in forests with outbreaks of mountain pine beetles in the Black Hills, South Dakota. Nest age and date were the most important predictors of nest survival. The odds of daily nest survival decreased 2% per day over the course of the nesting period, but increased 3% for each 1-day increase in nest age. Estimated nest success was above 80% for nests started early in the season (late April and early May) and decreased as a function of later nest-initiation date. The authors determined that availability of food is important for nest-site selection but not nest success in areas where overall food abundance is high, such as in a fire or beetle outbreak.

IV. DIET AND FEEDING

Diet—Black-backed woodpeckers feed largely on larvae of wood-boring beetles (Cerambycidae and Buprestidae; Dixon and Saab 2000). Bull et al. (1986) documented that the larvae of wood-boring beetles make up three-fourths of the black-backed's diet. Dixon and Saab (2000) report engraver beetles (Scolytidae) taken in New Hampshire; mountain pine beetles (*Dendroctonus ponderosae*) exclusively eaten in central Oregon lodgepole pine forests; and cerambycid *Monachamus oregonensis* eaten in northeastern California. Villard and Beninger (1993) observed that insects collected in Quebec, Canada were almost exclusively the larvae of the whitespotted sawyer, *Monachamus scutellatus*, a long-horned beetle. Black-backed woodpeckers also feed to a small extent upon weevils and other beetles, ants, insects, spiders, vegetable food, wild fruits, mast, and cambium (Dixon and Saab 2000).

Murphy and Lehnhausen (1998) analyzed stomach contents of 13 black-backed woodpeckers in a burned forest in interior Alaska, and found they were feeding primarily on wood-boring beetle larvae (Cerambycidae) with a very small prevalence of Scolytidae. The larvae of wood-boring beetles are best extracted from sapwood by excavating, which explained the prevalence of excavation as a method of foraging. The authors did not observe a secondary outbreak of egg-laying by wood-boring beetles when adults from a 1983 cohort emerged in 1985 and 1986.

Feeding Behavior—Black-backed woodpeckers fed on snags, as opposed to live tree, 97% of the time in burned forests in the Sierra Nevada, and preferentially selected the largest snags (50–100 cm and >100 cm dbh) (Hanson 2007). Black-backed woodpeckers scaled (systematically flaking off bark) 72% of the time and pecked and gleaned the remainder of the time in beetle-killed forests of northeastern Oregon (Bull et al. 1986). Villard (1994) also reported woodpeckers mostly foraged by scaling bark and excavating in unburned forests in Manitoba, Canada. Villard and Beninger (1993) found that black-backeds searched for food 97% of the time on fire-killed white pine and 3% of the time on eastern hemlock in a burned forest in Quebec, Canada. Villard and Beninger (1993) also documented that the woodpeckers foraged 100% of the time on the trunks of trees in winter, and 94% of the time on the trunk in spring, and were never observed foraging on the ground. Black-backed woodpeckers foraged on the largest limb size classes (>15 cm) in the winter. In the spring, the birds foraged on limbs >7.5 cm, and rarely (e.g., 5% of the time) on limbs smaller than 7.5 cm.

Villard (1994) studied 156 male and 15 female foraging black-backed woodpeckers in unburned boreal forests of Manitoba, Canada. Dead trees or tree substrates were used 88% of the time, and the birds always foraged on trunks. Black-backeds spent 41% of the time foraging on dead wood on the ground, and foraged significantly more often on lower portions of tree trunks. No differences were found in foraging behavior between the sexes. Overall, black-backed woodpeckers foraged mainly on fallen logs and at the base of tree trunks, digging deeper in larger trees.

Kreisel and Stein (1999) documented black-backeds in burned forests foraging upon standing dead trees 99% of the time and 1% of the time on logs during winter in the Kettle River Range in northeastern Washington. These birds foraged primarily on western larch (*Larix occidentalis*) and Douglas-fir (*Pseudotsuga menziesii*), on middle and lower trunks of trees. Trees >23 cm dbh were used significantly more than the proportion available (84% used versus 36% available).

Murphy and Lehnhausen (1998) studied foraging black-backed woodpeckers in a burned boreal forest in interior Alaska. Nearly all sightings were on moderately to heavily burned standing white spruces. The authors reported no sexual differences in foraging mode, but females foraged higher on trees and upon more heavily burned trees than males. These black-backeds excavated 64.5% of the time in 1984–1985 and 57.8% of the time in 1985–1986. Pecking constituted 33% of observations in 1985–86 and 25.7% of observations in 1984–85. The birds almost always foraged on portions of fire-damaged spruces where the bark was charred and closely matched their sooty-black dorsal plumage. Overall, the black-backed woodpecker is highly specialized in its foraging ecology and diet.

V. MIGRATION

Black-backed woodpeckers may sometimes migrate to relatively lower slopes in winter (Dixon and Saab 2000). The species periodically irrupts from its usual habitat in boreal forests in the northeastern and north-central United States, temporarily inhabiting forests just south of its normal range (AOU 1983). Yunick (1985) documented periods of irruptive activity that lasted several years and were interspersed with long lapses of no records. Irruptions in the north-central and northeastern United States have occurred in the early 1920s, the mid-1950s, the mid-1960s, and the early 1970s, and appeared to be linked to large-scale forest mortality such as forest fires, windthrow, and insect outbreaks (Yunick 1985). Others have attributed irruptions to successful breeding promulgated by high abundance of wood-boring insects following extensive fires, or either a lack of insects or overpopulation resulting from insect outbreaks in the woodpecker's resident range (Dixon and Saab 2000).

Murphy and Lehnhausen (1998) suggested that immigration of black-backed woodpeckers to a new burn depends not only on the habitat suitability of the new burn relative to the present habitat but also the ability of the birds to detect and move to the new burn. Hoyt and Hannon (2002) found that the ability of black-backeds to detect and occupy a new burn area appeared to diminish at a distance of more than 75 km, suggesting that substantial habitat linkages would likely be necessary for this species to travel significant distances (Hutto 1995).

RANGE AND DISTRIBUTION

I. RANGE-WIDE DISTRIBUTION

The black-backed woodpecker is a resident from western and central Alaska, southern Yukon, west-central and southern Mackenzie, northern Saskatchewan, northern Manitoba, northern Ontario, central Quebec, central Labrador and Newfoundland south to southeastern British Columbia, through the Cascade Mountains of Washington and Oregon, to the Siskiyou and Warner mountains and Sierra Nevada of California and west-central Nevada, through Montana to northwestern Wyoming and southwestern South Dakota, and to southwestern and central Alberta, central Saskatchewan, central and southeastern Manitoba, northern Minnesota, northeastern Wisconsin, north-central Michigan, southeastern Ontario, northern New York, northern Vermont, northern New Hampshire and northern Maine (AOU 1983; Figure 2 below). The species wanders irregularly south to Nebraska, Illinois, Indiana, Ohio, Pennsylvania, Western Virginia, New Jersey, and Delaware during irruptions (AOU 1983).

The California population of black-backed woodpeckers may be disjunct from the continuous boreal forest population that extends from Alaska to Newfoundland at more northerly latitudes. Available maps of the range of the black-backed woodpecker vary in depicting this geographic isolation. Figure 2 below shows range maps from recent editions of the National Geographic Society's Field Guide to Birds of North America and Sibley's Guide to North American Birds, which indicate a gap in distribution between the Cascades of Oregon to the northern Sierra Nevada, and Dixon and Saab (2000), which fails to depict the distributional gap. Hoyt and Hannon (2002) found that black-backed woodpeckers were absent in unburned stands within 50 km of a burn, but occupied unburned stands 75 km away from the burn. Thus, the woodpeckers may not readily detect new burns beyond 75 km from their current location. The distributional gaps shown in the maps below are larger than 75 km. Pierson et al. (2010), in a genetic analysis of black-backed woodpeckers from blood and feather samples, found that the eastern Oregon Cascades population is genetically distinct from the Rockies/boreal population, and that there is very little genetic exchange between the populations, which are separated by less than 75 km by the Columbia River Gorge. Pierson et al. (2010) concluded that the extent of the genetic distinction between the two populations was "similar to those documented among subspecies" in other birds occupying similar ranges. Pierson et al. (2010) did not collect genetic samples from the California population of black-backed woodpeckers, which are separated from the eastern Oregon Cascades population by possibly a greater distance than the separation between the Oregon Cascades and the Rockies/boreal population. Further study is warranted to clarify the relationship of the apparently disjunct population in California to other populations of the species.

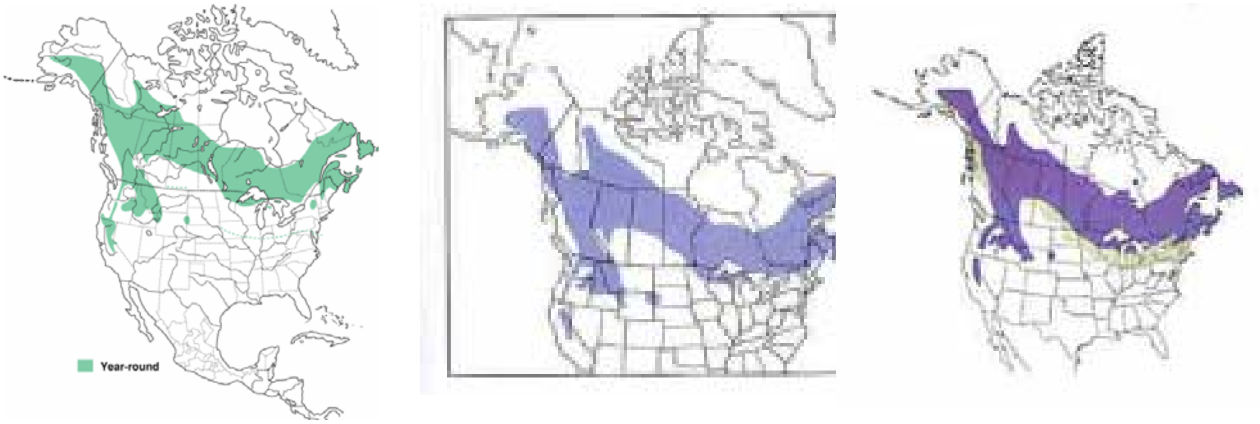

Figure 2. Maps of the Range of the Black-backed Woodpecker Across North America (from left to right: a) Dixon and Saab (2000) from Siegel et al. (2008); b) National Geographic Society Field Guide to the Birds of North America ; and c) Sibley's Guide to North American Birds.

Bock and Bock (1974) noted that the distribution of *P. arcticus* is related to the closed boreal and montane coniferous forest regions of North America, and that the northern limit of this continuous forest type coincides with the northern limits of the black-backed woodpecker. Overall, the black-backed woodpecker is associated with denser forests containing a diverse mixture of conifer species, none of which is essential to the woodpecker (as opposed to the three-toed woodpecker, *P. tridactylus,* which is closely tied to spruce).

While relatively widespread in range, the black-backed woodpecker is locally rare in abundance (AOU 1983) with low densities and large home ranges (Dudley and Saab 2007). Black-backed woodpeckers in California are no exception (Dawson 1923, Grinnell and Miller 1944, Small 1974).

II. CALIFORNIA DISTRIBUTION

In California, the black-backed woodpecker is a rare and very local resident of the middle and upper elevation montane forests of the Sierra Nevada Mountains, Warner Mountains, and Siskiyou Mountains. Dawson (1923) described the species' distribution in California as extending from Mount Shasta south to the Tahoe region, and Big Trees, Calaveras County, and in the Warner Mountains. Scientists later reported that the woodpecker's range in California extended to the southern Sierra Nevada. Grinnell and Miller (1944 at p. 248) outlined the geographic range of the woodpecker as in forest of either red fir or lodgepole pine, or a mixture of the two, or alpine hemlock, and "of small extent and interrupted nature; chiefly Cascade Mountains and high northern and central Sierra Nevada, south to about latitude 37° 30'; peripherally west through Siskiyou Mountains, east to Warner Mountains, Modoc County, and south to Tulare County." See Figure 3 below. Grinnell and Miller also reported that the species occurred at altitudes of approximately 1,300 m to 3,050 m.

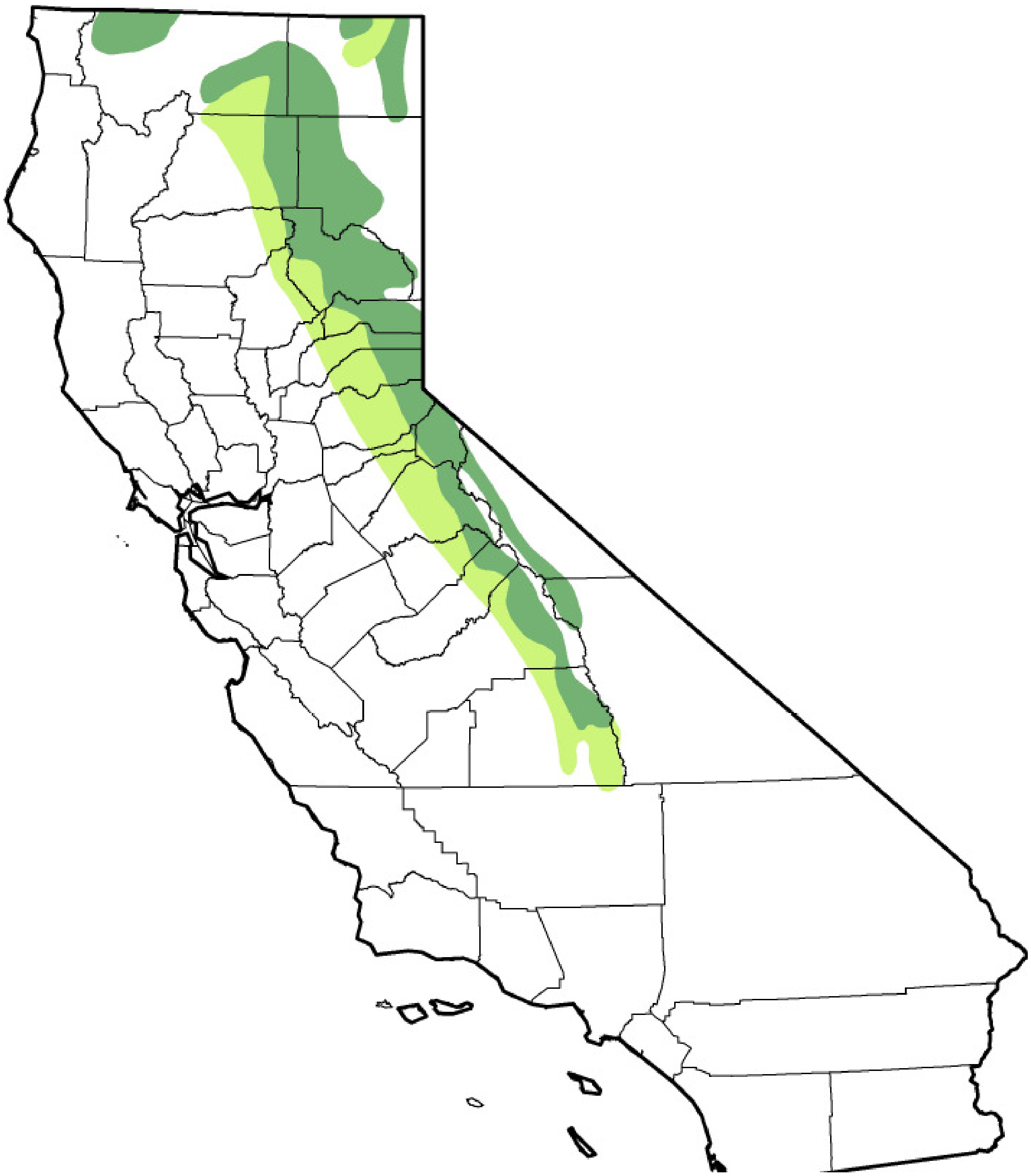

Figure 3. Distribution of the Black-backed Woodpecker across California (California Department of Fish and Game 2005, from Siegel et al. 2008). Light green indicates probable winter range, dark green indicates probable year-round range.

HABITAT REQUIREMENTS

Black-backed woodpeckers occur in a wide variety of conifer-forest types, but the greatest densities typically occur in unlogged, intensely burned conifer forests. At the landscape scale, while not tied to any particular tree species, black-backed woodpeckers generally are found in old conifer forests comprised of relatively high densities of larger trees (Russell et al. 2007, Hanson and North 2008, Nappi and Drapeau 2009).

Hoyt and Hannon (2002) compared black-backed woodpecker occupancy of recently burned, unburned mature, and unburned old-growth conifer dominated stands. The authors sampled occupancy in 191 conifer-dominated stands in northeastern boreal forest in Alberta using call broadcasts, and found 24 detections in burned forest, 8 detections in unburned forests > 50 km from burns, and none in stands within 50 km from burn. In the burn, black-backeds were more likely to be present in stands with a lower density of deciduous trees and a larger mean dbh overall. Results confirm that black-backed woodpeckers do occupy unburned old-growth forests in the northeastern boreal forest of Alberta but at a lower rate than in burned forests. Moreover, there may be an effect of distance from recent burn on occupancy of unburned old-growth forests, especially old black spruce stands. In other words, black-backed woodpeckers within 50 km of the fire perimeter may have emigrated to the burn, resulting in a lack of birds within this distance. The presence of jack pine may have contributed to prolonged occupancy by black-backed woodpeckers at this site compared with Murphy and Lenhausen (1998), who studied woodpecker use of burned stands that comprised >90% spruce. Hoyt and Hannon (2002) hypothesized that thick bark of jack pine makes these trees more fire resistant than spruce, and the thick bark promotes moisture retention after death, prolonging suitability of this tree species to wood-boring insect larvae.

While black-backed woodpeckers can (rarely) be found in unburned forests, the species strongly favors burned habitats, and in some regions were found *only* in recently burned forests. Hutto (1995) completed a comprehensive literature review in which 78% of studies found black-backeds in recent intensely burned forest and only 12% found the species in three other cover types. While black-backed woodpeckers were detected on rare occasions in other cover types, often there was either a burned forest nearby or a prior burning treatment on their plot. Records exist of black-backeds in unburned forests in Idaho and Montana, but these appear to be the exception rather than the rule (Hutto 1995). Similarly, Smucker et al. (2005) conducted surveys on burned and unburned transects before fire and for 3 years post-fire in west-central Montana, and detected black-backed woodpeckers at burned points only.

As part of a long-term study, Hutto (2008) analyzed 48,155 point counts conducted in 20 different vegetation types throughout northern Idaho and Montana in the USFS Northern Region Landbird Monitoring Program from 1994–2007 to determine habitat correlations of the black-backed woodpecker. Points were >250 m from any other points and dispersed along 10-point transects that were distributed in a geographically stratified manner across the region. Hutto (2008) used only single visits to a given point, utilizing data from the first year a point was visited for his analysis, resulting in 13,337 independent sample points. Samples within post-fire vegetation were collected from an additional 3,128 points distributed along 50 different recently burned (1–4 years post-fire) forests. Hutto (2008) concluded that the species is relatively restricted to burned forest conditions because 96% of all black-backed woodpecker detections were in burned forest conditions, and because the distribution of playback detections reflected well the distribution of point-count detections (playback locations were separated by 500 m).

I. NESTING HABITAT

Black-backed woodpeckers are one of the most highly selective bird species not only with respect to burned or otherwise disturbed forests, but also with specific nesting and foraging trees used within a stand (Hutto 1995, Raphael and White 1984). Black-backed woodpeckers nest in a variety of tree species, both live and dead, but exhibit patterns of selection at a local scale dependent upon forest type and condition. In general, black-backed woodpeckers excavate nests in the sapwood of relatively hard dead trees with little decay. Black-backeds tend to select nesting stands with higher tree densities than available sites, and prefer to nest in unlogged burned forests over logged burned forests. Nest sites in burned forests are strongly correlated with areas of high pre-fire canopy cover.

Nest Tree Selection—Dawson (1923) noted that black-backed woodpecker nests are typically located in a hole in a stump or stub up to 2.4 m above the ground. Dixon and Saab (2000) reported the species nesting in live and dead trees of various species including lodgepole pine (*Pinus contorta*), ponderosa pine (*P. ponderosa*), Douglas-fir, red fir (*Abies magnifica*), quaking aspen (*Populus tremuloides*), subalpine fir (*A. lasiocarpa*), western larch, red maple (*Acer rubrum*), paper birch (*Betula papyrifera*), jack pine (*Pinus banksiana*), red pine (*P. resinosa*), tamarack (*L. laricina*), black spruce (*Picea mariana*), white spruce (*P. glauca*), balsam fir (*A. balsamea*), noble fir (*A. procera*), and silver fir (*A. alba*).

Goggans et al. (1988 cited in Dixon and Saab 2000 at p. 11) studied black-back woodpeckers nesting in beetle-killed lodgepole pine-dominated mixed conifer forests and pure lodgepole pine forests in central Oregon. All 35 nests located were in lodgepole pine trees, most with internal evidence of heartrot. Table 2 below shows the species and condition of 61 nest trees utilized by black-backed woodpeckers in three different areas of the Rocky Mountains, two burned and one undescribed as reported in Dixon and Saab (2000 at p. 11). Most nests (95%) were in snags.

Table 2: Species and Condition (Snag or Live) of Nest Trees Used by Black-backed Woodpeckers from 3 studies.

Study	Site description	n	PIPO[1] snag	PSME[2] snag	PSME live	PICO[3] snag	PICO live	ABLA[4] live	LAOC[5] snag
Caton 1996	NW MT, burned	11		2					9
Hoffman 1997	NW WY, undescribed	15			1	12	1	1	
Dixon and Saab 2000	SW ID, burned	35	19	16					

[1] Ponderosa pine, [2] Douglas-fir, [3] Lodgepole pine, [4] Subalpine fir, [5] Western larch

Among 5 woodpecker species in a study of burned forests of western Idaho, black-backed woodpeckers selected the smallest-diameter snags for nesting (average = 39.7 ± 2.1 cm, *n* = 35; Saab et al. 2002). Black-backeds typically nested in trees with light to medium decay and often with intact tops, possibly because the species is a strong excavator and is able to excavate hard snags and live trees (Raphael and White 1984, Saab and Dudley 1998). Raphael and White (1984) also reported that harder snags were used for nesting more than expected based on their availability in unburned forest adjacent to intensely burned forest in the Sierra Nevada, California. Five of 7 nests were in snags, while the other 2 nests were in dead portions of live trees (Raphael and White 1984).

While nest trees selected by black-backed woodpeckers were smaller than those selected by some other cavity nesters (Saab and Dudley 1998, Raphael and White 1984), average sizes of nest trees still were larger than the average available snag. Saab and Dudley (1998) reported that the mean diameter of black-backed nest trees was 32.3 ± 2.8 cm.

Nest Stand Selection— Black-backed woodpeckers strongly select nest stands in burned, unlogged forests over burned, logged forests. Hutto and Gallo (2006) located 10 nests in unlogged plots and none in salvage-logged plots in burned mixed-conifer forest in Montana. Saab and Dudley (1998) monitored 17 black-backed woodpecker nests from 1994 to 1996 in forests in western Idaho that had burned in 1992 and 1994. Among all cavity-nesting bird species studied, black-backeds selected nest sites with the highest tree densities (average = 122.5 ± 28.3 trees $\geq$23 cm dbh) per hectare. Moreover, nest densities were nearly four times higher in unlogged high-intensity burn areas versus "wildlife salvage" and were more than five times higher than in "standard salvage" areas, despite 32–52% retention of snags 23–53 cm dbh, and ~ 40% retention of snags > 53 cm dbh (Dudley and Saab 1998). In the small number of nests found in salvage-logged areas, black-backeds selected stands with snag densities about 2.6 to 4.3 times higher than snag densities at random sites (Dudley and Saab 1998). Hutto and Gallo (2006) found 0.9 black-backed nests/ha in unlogged heavily burned forest and 0/ha in salvage logged areas. Numbers of nesting black-backeds were significantly reduced in burned, logged stands compared to burned, unlogged stands in Montana and Wyoming as well (Harris 1982 and Caton 1996 as cited in Dixon and Saab 2000). Cahall and Hayes (2009) found that, consistent with the "salvage-effect hypothesis," black-backeds were significantly more abundant in unlogged burned forest than in areas subjected to any salvage logging, and salvage logging of reduced intensity "did not mitigate differences in bird density or abundance." Thus, the black-backed is adversely impacted by even partial salvage logging.

After continued nest monitoring in the western Idaho study described above, Saab et al. (2002) reported 29 black-backed woodpecker nests in unlogged burned forests and only 6 nests in partially logged burned forests. Of all 7 cavity nesting species monitored by the authors, snag densities were highest at black-backed nest sites (*n* = 4 sites in logged; 13 in unlogged), and lowest at random sites (*n* = 49 sites in logged and 40 in unlogged). The authors also modeled habitat variables for predicting black-backed nests and found that stand area of high-intensity burned Douglas-fir with high pre-fire crown closure was the most important variable in predicting presence of nests. Probability of nest occurrence was highest when nest stand area of Douglas-fir with pre-fire high crown closure (>70%

crown closure pre-fire) was over 30 hectares. The nest stand is a subset of the overall home range, which is much larger (see below). In landscapes where nest stand area was outside of this range, other landscape features necessary for nesting black-backed woodpeckers were likely reduced in availability or absent. Nests were not present where nest stand area was less than 12 ha, and nesting probability was highly variable when nest stand area was between 12 and 25 ha. The authors do not report whether any nests were located in high-intensity burned, high pre-fire crown closure stands >70 ha, or if there were not any nest stands this large, or if any surveys were conducted in these large stands. Other data indicate black-backeds use large high-intensity patches hundreds of hectares in size (Dixon and Saab 2000).

Russell et al. (2007) compared the ability of models using remote-sensed data only, with models derived from field-collected data plus remote-sensed data, to identify potential black-backed woodpecker nesting habitat in post-fire landscapes in western Idaho. The authors measured microhabitat characteristics in a 0.04-ha circular plot around a nest, and landscape characteristics in a 1-km radius circle around a nest. The best model describing black-backed woodpecker nest locations included higher pre-fire crown closure on pixel and landscape scales, as well as higher burn intensity, and larger dbh, higher large snag densities, and larger patch area. Only 11% of black-backed nests were located in pixels with 0–40% pre-fire crown closure versus 48% of non-nest comparison plots. Within a 1-km radius of black-backed nests (on a landscape-level), an average of 55% of the area was characterized by pre-fire crown closure >40%, compared to 47% of landscape in non-nest random locations. Mean fire intensity within a 1-km radius of nests was dNBR=513, while it was only dNBR=358 at non-nest random locations (dNBR=367 is a threshold used by the Forest Service to separate moderate intensity from high intensity [Miller and Thode 2007]). The authors concluded that both field-collected microhabitat data and remotely sensed landscape data were necessary to correctly identify nest locations because remote-sensed data alone performed poorly in predicting nest locations. The authors suggested that models were able to distinguish between nest and non-nest locations because the species is a habitat specialist. The results of Russell et al. (2007) and Saab et al. (2002) offer compelling evidence that black-backed woodpeckers depend upon large patches of dense, old closed-canopy forests that burn at high intensity for nesting. Results from studies on foraging requirements support the same conclusions (see **Foraging Habitat**, below).

Vierling et al. (2008) examined post-fire nest density, reproductive success, and nest-site selection in the context of pre-fire conditions and post-fire effects in the Black Hills, western South Dakota, for 1–4 years after fire. Mean dbh of nest tree (n = 20) was 25.7 ± 1.09 cm compared to mean dbh at random sites (n = 151) of 19.8 ± 0.73 cm; mean distance to an unburned edge from the nest tree was 605.95 ± 61.0 m compared to random distance of 168.7 ± 10.8 m; mean percent of low-intensity fire within 1 km of nest tree was 20.8 ± 1.90% compared to random 24.9 ± 0.54%, and mean snag density within 11.3 m of nest tree was 26.8 ± 4.17 m compared to random 13.3 ± 0.94 m. In other words, black-backeds selected larger-than-available trees for nesting that were farther from the edge of the burn, with lower amount of low-intensity fire and a greater snag density surrounding the tree than randomly sampled potential nest sites. In burned forests of Idaho, Saab et al. (2009) found that black-backed woodpeckers selected nest sites with the highest mean snag densities among cavity-nesting birds (316 snags/ha >23 cm dbh).

Vierling et al. (2008) also documented that the number of black-backed woodpecker nests was highest in sites with the highest pre-fire canopy, with 95% of nests in areas where pre-fire canopy cover was medium (40–70% pre-fire canopy cover) or high (70–100% pre-fire canopy cover) (Table 3). Nest sites that burned at the highest intensity also had the greatest percent reproductive success compared with moderate- and low-intensity burned nest sites (Table 4). Russell et al. (2007) found that 89% of black-backed nests were in areas where pre-fire canopy cover was 40–100%, while only 52% of non-nest random locations had 40–100% canopy cover. Nappi and Drapeau (2009) found that black-backed nest density and reproductive success were highest where high-intensity fire occurred in old forest, rather than in young forest.

Table 3: Average density of nests/100 ha ($\pm$SE) of black-backed woodpeckers nesting in the Jasper Fire in the Black Hills, South Dakota.

	High prefire canopy cover (*n* = 2 sites)	Moderate prefire canopy cover (*n* = 2 sites)	Low prefire canopy cover (*n* = 2 sites)	Overall density
No. of nests	11	8	1	20
Mean density	0.28	0.31	0.03	0.24
SE	0.08	0.08	0.02	0.05

Table 4: Reproductive variables of black-backed woodpeckers between 2002 and 2004 in the Jasper Fire in the Black Hills, South Dakota, in nests located within burned patches of high, moderate, or low intensity.

	High intensity	Moderate intensity	Low intensity
No. of nests monitored	10	6	5
Daily survival rate	0.995	0.982	0.986
SE	0.005	0.12	0.014
% reproductive success	80.0	50.0	60.0

Black-backed woodpeckers are important primary cavity excavators in intensely burned snag forests, providing nesting sites for other cavity-nesting bird and mammal species. Saab et al. (2004) reported that 27% of black-backed woodpecker cavities subsequently were re-used by other weak-excavator and non-excavator bird species. In burned forests of Montana, Hutto and Gallo (2006) documented 6 cavities made by black-backed woodpeckers that were re-used 7 times by other species including northern flicker (*Colaptes auratus*; 2 nests), white-breasted nuthatch (*Sitta carolinensis*; 2 nests), house wren (*Troglodytes aedon*; 2 nests), and mountain bluebird (*Sialia currucoides*: 1 nest). Half the black-backed cavities were reused by black-backed woodpeckers and 100% were re-used by another species.

II. FORAGING HABITAT

In general, black-backed woodpeckers forage on the trunks of larger-sized standing dead trees within dense old stands in high-intensity burned conifer forests. Dead forage trees that were used tend to be in a less-deteriorated condition than available dead trees. In burned forests, black-backed woodpeckers forage mostly in stands that had not been subject to salvage logging, similar to results from studies on nesting-habitat selection. Trees used for foraging were linked to high densities of wood-boring beetle larva excavation holes. In Idaho, in a 314-ha area around black-backed nests (1-km radius), pre-fire canopy cover was high and the mean dNBR fire severity value was 513 (Russell et al. 2007), equating to very high intensity (Miller and Thode 2007). In the Sierra Nevada, black-backeds were found foraging only in dense mature/old-growth forest that burned at high intensity (Hanson and North 2008).

Black-backed woodpeckers forage almost exclusively on heavily charred hard snags and fallen logs. Nearly all sightings of foraging black-backeds were on moderately to heavily scorched standing white spruces in burned boreal forest of interior Alaska (Murphy and Lehnhausen 1998). The birds were observed less frequently in the interior of the burn where the spruces were killed immediately and heavily scorched by the fire; the authors attributed the lack of foraging black-backeds in the interior of the burn to potentially low larval survival there due to rapid desiccation of sapwood. Indeed, abundance of cerambycid eggs was initially low on those heavily scorched spruces (Murphy and Lehnhausen 1998). Kreisel and Stein (1999) found that black-backed woodpeckers in burned forests foraged upon standing dead trees 99% of the time and only 1% of the time on logs during winter in the Kettle River Range in northeastern Washington. The birds foraged primarily on western larch and Douglas-fir on middle and lower trunks of trees. For all woodpecker species in the Kettle River Range study, trees >23 cm dbh were used significantly more than the proportion available (84% used versus 36% available).

Nappi et al. (2003) studied foraging ecology of black-backed woodpeckers and correlations to density of wood-boring beetle larva in unlogged eastern black spruce boreal forest in Quebec, Canada one year after a fire. Modeling demonstrated that dbh and crown condition were significant predictors of snag use for foraging: the probability that a snag was used increased with a higher dbh and a lower deterioration value. The model predicted use of high-quality snags during 20 of 26 foraging observations. Snags of high predicted quality contained higher densities (mean per snag) of larval entrance holes, larval emergence holes, and foraging excavations of woodpeckers than snags of low predicted quality. Among snags of high predicted quality, entrance hole density was significantly higher for the 1–3 m height section of the tree than for the 0–1 m section, whereas among snags of low predicted quality, entrance larval hole density was significantly higher in the 0–1 m and the 1–3 m sections. Thus, selection of larger and less-deteriorated snags is linked to higher availability of insect prey. The authors also found that larger snags had higher densities of wood-boring beetle larva entrance holes than smaller snags (see also Hutto 1995), and that for the same dbh, a less-deteriorated snag had a higher probability of use by black-backed woodpeckers than did a more deteriorated one. Snag deterioration combined with dbh influenced the density of wood-boring beetle larvae. Overall, black-backed woodpeckers avoided more degraded snags (e.g., pre-fire snags) in which wood-borers probably oviposited less and where larvae were more susceptible to desiccation. The authors concluded (at p. 509) that “[t]he importance of post-fire forests as a foraging habitat for black-backed woodpeckers may vary in regards to pre-fire characteristics of trees and conditions induced by fire.”

Hutto and Gallo (2006) found that the number of snags needed for foraging black-backed woodpeckers was higher than the number needed for nesting. The authors stated at p. 828 that "[t]hese results highlight the fact that we need to appreciate snags as food resources as well as nest-site resources and that, for timber-drilling woodpecker species in particular, the number of snags needed to meet food resource needs appears to be much greater than the number needed to meet nesting requirements." Within dense stands, black-backed woodpeckers in California foraged on the larger-sized snags. Hanson (2007) found that black-backed woodpeckers foraged more on large snags (≥50 cm) than would be expected based on availability in several burned sites throughout the Sierra Nevada, California. All 4 of the instances where black-backeds were located in the medium-sized (25–49 cm dbh) class, the birds foraged on snags 40–49 cm dbh, indicating that the birds may select snags ≥40 cm within stands dominated by smaller-sized trees. In addition, the black-backeds were found foraging exclusively in high-intensity burned stands that were unlogged, and not in unburned, moderate intensity, or salvage logged areas (Hanson 2007, Hanson and North 2008). The unlogged high-severity stands had 92–100% tree mortality, and an average of 252 snags/ha > 25 cm dbh, about half of which were > 50 cm dbh (Hanson and North 2008). Hanson and North (2008) avoided point counts within 100 m of another fire intensity category, so there were no point counts in moderate-intensity areas at the edge of high-intensity areas.

Hutto (2006 at pp. 985–986) provided a succinct and articulate explanation for the possible reasons why black-backed woodpeckers are so strongly tied to recently burned, dense snag-forest habitats containing large burned trees:

> "At least one-fourth of all bird species in western forests and perhaps even as much as 45 percent of native North American bird populations are snag-dependent; that is, they require the use of snags at some point in their life cycle. In burned conifer forests, the most valuable wildlife snags are also significantly larger than expected owing to chance, and are more likely to be thick-barked, such as ponderosa pine, western larch, and Douglas-fir, than thin-barked such as Englemann spruce, true firs (*Abies*) and lodgepole pine tree species. The high value of large, thick-barked snags in severely burned forests has as much to do with the feeding opportunities as it does the nesting opportunities they provide birds. The phenomenal numerical response of woodpeckers of numerous species that occupy recently burned conifer forests during both the breeding and nonbreeding seasons is most certainly associated with the dramatic increase in availability of wood-boring beetle larvae that serve as a superabundant food resource for woodpeckers. This helps explain why, in contrast with snags in green-tree forests, valuable wildlife snags in burned conifer forests include not only relatively soft snags (used for nesting by both cavity-nesting and open-cup-nesting species) but also snags that are at the sounder end of the snag decay continuum because the latter are what both beetles and birds require for feeding purposes and what many bird species use for nesting purposes. Consequently, burn specialists such as the black-backed woodpecker, which depends on snags for both feeding

and nesting, settle in areas with higher snag densities than expected owing to chance."

III. HOME-RANGE SIZE

Dudley and Saab (2007) report that home-range sizes of black-backed woodpeckers have been estimated from observational data (e.g., 61 ha in Vermont; Lisi 1988, and 40 ha in Alberta; Hoyt 2000 as cited in Dudley and Saab 2007) and nesting densities (4 pairs per 500 ha in western Idaho; Dixon and Saab 2000; 9 pairs per 200 ha in Idaho and Montana; Powell 2000 as cited in Dudley and Saab 2007; 15 nests per 100 ha in Quebec; Nappi et al. 2003). However, these estimates do not incorporate actual locations of foraging individuals, which can only be determined from radio-telemetry. Three studies have reported home-range size of black-backed woodpeckers using radio-telemetry, all of which yielded much larger home-range sizes than estimates from observational data alone.

In southwest Idaho, 1 adult male black-backed woodpecker was radio-tracked during June and July in unlogged, intensely burned pondersa pine-Douglas-fir forest 4 years post-fire; home-range size was 72 ha (Dixon and Saab 2000). Goggans et al. (1998 as cited in Dixon and Saab 2000) reported median home-range size for 3 individual woodpeckers from radio-telemetry was 124 ha (range 72–328 ha) in beetle-killed lodgepole pine forests of central Oregon. Dudley and Saab (2007) radio-tracked 2 males 6 years, and 2 males 8 years post-fire in burned ponderosa pine/Douglas-fir forests in southwestern Idaho. Average home-range size was 322 ha (range 123.5–573.4 ha) using 95 percent minimum convex polygon and 207 ha (range 115.6–420.9 ha) using fixed-kernel estimates (Table 5).

Table 5: Home-range size (ha) for 4 radio-tagged black-backed woodpeckers in ponderosa pine / Douglas-fir forests of southwestern Idaho, 6 and 8 years following fire. From Dudley and Saab (2007).

			MCP [c]			
Time since fire [a]	*N*	Distance (m) [b]	95%	100%	95% FK [d]	95% bootstrap [e]
6 years						
Male 1	42	673.8 (91.6)	233.6	354.6	115.6	130.0 (118.2-141.8)
Male 2	66	646.1 (65.8)	359.0	445.9	130.7	139.2 (131.1-147.4)
8 years						
Male 3	48	644.8 (84.4)	123.5	150.4	161.3	174.7 (158.4-191.0)
Male 4	53	860.8 (115.5)	573.4	766.1	420.9	521.9 (470.9-572.9) [a]

[a] Males 1-3 radio-tracked in 2000, male 4 in 2002
[b] Mean distance between successive radiotelemetry relocations. Standard error in parentheses.
[c] Minimum convex polygon
[d] Fixed-kernel
[e] Smoothed bootstrap mean area (95% confidence interval)

Larger areas may be required during the post-breeding period, and as time elapses since fire (Dudley and Saab 2007). Home-range sizes were significantly larger at 8 years post-fire than 6 years post-fire (Table 5), indicating that birds may have expanded their home ranges as time progressed after fire to meet foraging requirements (though sample sizes were small). The authors suggest that birds may have had to move greater distances to find food as beetle populations dwindled. All the males moved to adjacent unburned areas, suggesting that these older burned forests (6–8 years post-fire) may have been less suitable as foraging habitat than recently burned forests. One male had a home range 2–3 times larger than other males (male 4; Table 5). The authors noted that this male was often located at distances >1.4 km into the adjacent unburned forest where he foraged in stands with scattered dead and dying trees (similar to use of burn perimeters by foraging black-backeds in Alaska; Murphy and Lenhausen 1998).

Results from radio-telemetry studies of black-backed woodpeckers provide important insights into population dynamics. Because all 4 individuals utilized adjacent unburned areas in older post-fire forests, Dudley and Saab (2007) postulated on p. 597 that "[d]uring periods of infrequent forest fires, green forests adjacent to old burns may play a role in maintaining local populations of black-backed woodpeckers until new forest burns are created," a hypothesis proposed earlier by Hutto (1995, 2006).

Dudley and Saab (2007) documented large variation in home-range size among individuals (Table 5). Home-range estimates for black-backed woodpeckers also exhibited high variation in beetle-killed forests, ranging from 72 to 328 ha for 3 birds (100 percent MCP, Goggins et al. 1989 reported in Dixon and Saab 2000). However, direct comparisons of home-range estimates between the two studies were not possible because each used different methods of data collection, were conducted on different study areas, and were sites subjected to different disturbances (i.e., fire versus beetle-killed lodgepole pine during a 15-year epidemic).

Importantly, Dudley and Saab (2007) documented 2–8 centers of activity of relatively high-quality habitats for each radio-tagged male, with "high-quality" defined as areas where sightings were clumped. These high-quality habitats were patchily distributed. The authors cautioned that using fixed-kernel estimates alone could seriously underestimate the extent of required habitat if high-quality habitats are isolated and vary greatly in size; using MCP estimates would help incorporate these patchily distributed habitats when quality is unknown. The authors suggested that MCP and fixed-kernel home-range estimates be used together, thus allowing the manager to delineate enough high-quality habitat within an overall landscape to support black-backed woodpeckers during the post-fledging period.

Dudley and Saab (2007) also suggested that a potential home range be estimated by adding together all the areas of all high-quality habitats (patches) for one individual until approximately the size of the 95 percent fixed-kernel home range estimate is obtained [in their study, this area was 207 ha]. The extent of the areas, determined by encircling all the selected high-quality patches, should approximate the mean of the 100 percent MCP estimates from all home ranges [in this study, the mean of MCP estimates was 429 ha]. It would then be possible to estimate the total number of potential home ranges within the overall fire area.

ABUNDANCE AND POPULATION TREND

Black-backed woodpeckers are strongly associated with changes in forest structure induced by fire and insect outbreaks (Dixon and Saab 2000). The species depends upon an environment that is unpredictable and ephemeral, which may remain suitable for only 10 years and often less, depending upon local conditions (Hutto 1995, Murphy and Lehnhausen 1998, Hoyt and Hannon 2002, Saab et al. 2004, Saab et al. 2007, Hutto 2008). Thus, black-backed woodpecker populations are subject to significant fluctuations—numbers are very low in forests without significant natural disturbance, but densities can increase due to demographic bursts or recruitment related to temporarily super-abundant foods, such as wood-boring bark beetles attracted to recently burned forests (Dixon and Saab 2000). Populations of black-backed woodpeckers are clearly regulated by the extent of fires and insect outbreaks (Dixon and Saab 2000) and by the management actions conducted within the disturbed forest habitat, such as salvage logging (Hutto and Gallo 2006).

Factors Influencing Abundance and Population Trends—The black-backed woodpecker inhabits and breeds successfully in unburned mature coniferous forests (Setterington et al. 2000), but throughout its range it is far more abundant in—and clearly recruits to—forests recently burned at high intensity (Hutto 1995, Hoyt and Hannon 2002, Smucker et al. 2005, Hutto 2008). Setterington et al. (2000) found black-backed woodpeckers to be uncommon in all unburned balsam fir forests age classes in Newfoundland, and were absent entirely from their study area in 1994.

Where the species does occur in unburned forests, it appears to depend upon older forests for persistence. Setterington et al. (2000) found significantly more black-backed woodpeckers in 80-year-old forest than younger age classes. Hoyt and Hannon (2002) documented that unburned old-growth coniferous forests (>110 years) are important to this species during times when suitable recently burned forest is unavailable. Moreover, once a forest burns or experiences large-scale insect mortality (with tree mortality levels mirroring higher intensity wildland fire), black-backed woodpeckers select stands with larger-sized dead trees than randomly available on the landscape, and that contained high pre-disturbance crown closure, for nesting and foraging (Saab et al. 2002, Russell et al. 2007, Hanson 2007, Vierling et al. 2008). Thus, black-backed woodpeckers depend upon naturally disturbed mature and old-growth forests for population persistence.

Variation in survey methodology, reporting units, size of study patches, and salvage logging complicates comparisons of abundance and population trends among studies of blacked-backed woodpeckers, but when a common variable is used and units are standardized (i.e., number of pairs or nests per 100 ha) it is possible to detect broad patterns, the influence of time since disturbance, and regional variation in densities. Table 6 summarizes data from studies estimating pair/nest densities in generally unlogged landscapes affected by fire or insect mortality throughout the range of the species (nest density studies conducted in unlogged remnant patches in an otherwise heavily logged landscape can present misleading results because woodpeckers displaced by logging may temporarily crowd into the only remaining habitat). Densities of black-backed woodpeckers in ponderosa pine and Douglas-fir forests of the Rockies ranged from about 0.8 nests per 100 ha (about one nest for every 300 acres of burned forest) in the first several years post-fire, and decreased to 0.25 nests per 100 ha by 7–10 years post-fire (about one nest for every 1,000 acres of burned forest). Furthermore, nest densities in the Black Hills of South Dakota in both burned and beetle-killed stands were lower overall than in the Rocky Mountains, suggesting regional differences in abundance.

Table 6. Number of black-backed woodpecker nests located per 100 ha in burned and beetle-killed forests.

Study	Location	Years since disturbance	Number of nests per 100 ha		
				Burned	***Insect kill***
Saab et al. (2007)	Rocky Mts, ID	1-6		0.85	-
Saab et al. (2007)	Rocky Mts, ID	7-10		0.25	-
Dixon and Saab (2000)	Rocky Mts, ID	1-5		0.80	-
Vierling et al. (2008)	Black Hills, SD	1-4		0.30	-
Bonnot et al. (2008)	Black Hills, SD	1-7 yr		-	0.33 nests
Powell (2000)	Rocky Mts, MT	> 1 yr	-	-	0 nests

Black-backed woodpecker nest density data are lacking in the scientific literature in California. Bock and Lynch (1970) reported figures on density, but this was based upon inferred density derived from detections in only one small (8.5 ha) burned plot in a heavily logged landscape, and one small (8.5 ha) unburned plot adjacent to the fire area. Density cannot be extrapolated from two individual plots, wherein no actual nests were located, and where the two plots were much smaller than the home range of the species. Data from Apfelbaum and Haney (1981), pertaining to one single 6.25 ha plot, and Raphael and White (1984), pertaining to only two small burned plots (8.5 ha and 6.7 ha) and two adjacent unburned plots (8.5 ha) in a heavily salvage logged landscape, cannot be used to determine black-backed woodpecker nest density for the same reason.

In 2009–2010, data were collected to determine nest density of numerous avian species, including black-backed woodpeckers, in three large fire areas of the northern Sierra Nevada, the 2008 Cub Complex fire, the 2007 Moonlight fire, and the 2000 Storrie fire. In 13 plots, each 20 ha in size, no black-backed woodpecker nests were found in the Storrie fire 9 and 10 years post-fire, respectively (Burnett, pers. comm. 2009, 2010 [unpublished data]). In 2009, 3 nests were located in 26 plots (20 ha each) in the Moonlight fire (2 years post-fire), and 1 nest was located in 13 plots (20 ha each) in the nearby Cub Complex fire (one year post-fire), though the investigators estimated that 10–30% of existing nests likely went undetected (Burnett, pers. comm. 2009 [unpublished data]). Making this adjustment for undetected nest sites, and assuming about 1/3 of nests were missed, the black-backed woodpecker nest density 1–2 years post-fire was about 0.7 nests per 100 ha, similar to the published studies reported in Table 6 above for the Rocky

Mountains. In 2010, nest density was over twice this high in these two fire areas in the same plots (Burnett, pers. comm. [unpublished data]). However, this result should be taken with some caution, since much of the Moonlight fire area—which represented the largest single block of black-backed woodpecker habitat in California—was heavily salvage logged in the middle of nesting season in 2010, displacing black-backeds and creating the potential for unnatural crowding in remaining habitat in the Moonlight fire, and possibly also in the nearby Cub Complex fire. Moreover, black-backed woodpeckers remaining in the 9-year-old Storrie fire likely would have colonized the adjacent, and much more recent, Cub Complex fire. Additional study is needed to better determine black-backed woodpecker nest density in the Sierra Nevada, especially without the influence of salvage logging.

Post-fire occupancy rates differ between burned and unburned sites and decline over time. For example, Hoyt and Hannon (2002) found that between 30 and 50 percent of 1- to 8-year-old burned stands were occupied by black-backed woodpeckers. In contrast, only 13 percent of unburned stands were occupied in one year and 0 percent in another, and the woodpeckers were not detected at all in 16- and 17-year-old burns. The unburned stands were extremely dense old-growth boreal forest in Canada, with 5,650 trees/ha, including both live trees and snags (Hoyt and Hannon 2002). Recent post-fire habitats harbor the greatest numbers of black-backed woodpeckers, while older burns become unsuitable.

Post-fire occupancy by black-backed woodpeckers also is correlated to fire intensity. Hutto (2008) concluded that black-backed woodpeckers were highly specialized in their use of highly burned conifer forests in northern Idaho and western Montana. Probability of detecting black-backed woodpeckers increased with fire intensity (Figures 4 and 5) (note: the medium "severity" in Figure 4 includes up to 100% canopy mortality [Hutto 2008]), and the birds occurred with increasing likelihood as proximity to fire or fire intensity increased (Figure 5). Hutto concluded on p. 1,831 that "[n]o other bird that occupies conifer forests is as specialized on such a small subset of forest types or conditions…This bird species was also relatively restricted in its distribution…to the severely burned end of the fire severity spectrum."

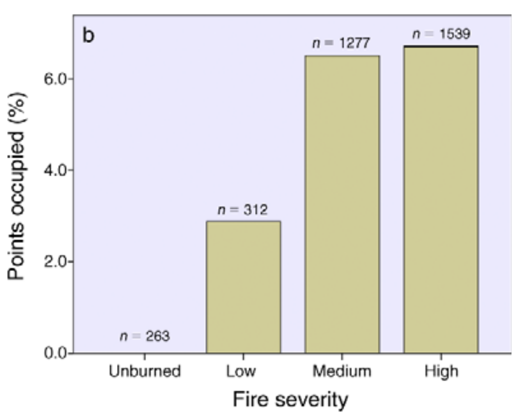

Figure 4. The probability of detecting a black-backed woodpecker increases (χ^2 = 36.07, df = 3, *P* < 0.0001) with fire severity. From Hutto (2008 at p. 1830).

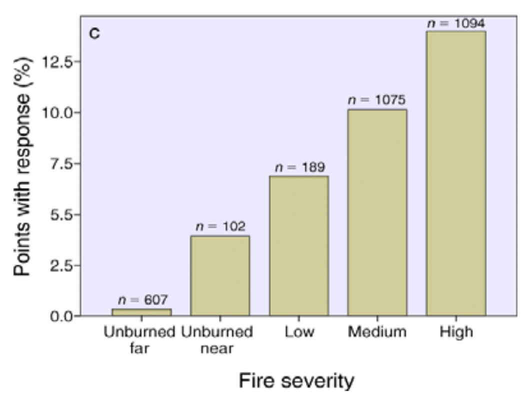

Figure 5. The probability of detecting a black-backed woodpecker increased (χ^2 = 132.40, df = 4, *P* < 0.0001) with fire severity. From Hutto (2008 at p. 1830).

Spatial patterns of fire are also critical to black-backed woodpecker populations. Hoyt and Hannon (2002) postulated that small fires (<2,000 ha) may represent stepping stones between large patches of recently burned habitat. Their results in burned boreal forests in Alberta, Canada also indicated a possible effect of distance from recent burn on occupancy of unburned old-growth forests by black-backeds, as none were found in unburned stands within 50 km from the burn. Apparently the fire attracted all black-backed woodpeckers inhabiting suitable unburned forests within 50 km from the fire perimeter. Hutto (2008) found that black-backed woodpeckers were detected over 50 times more frequently within the perimeters of burned forests (1–4 years post-fire) than in unburned forests (see Figs. 4 and 5 above, and note that "unburned near" in Fig. 5 pertained to small unburned inclusions *inside* fire perimeters). Hutto (1995) suggested that black-backed woodpecker presence in unburned forests may represent non-viable "sink" populations.

The fact that not every fire necessarily induces significant bark-beetle colonization (Murphy and Lehnhausen 1998) may explain why not all recently burned forests are occupied by black-backed woodpeckers. Hutto (2008) reported that black-backed woodpeckers were detected at fewer than 6% of 3,128 point counts conducted in recently burned coniferous forests throughout northern Idaho and western Montana. Where the playback method was used, even in high-intensity fire areas (n = 1094) the detection probability was only about 14% (Hutto 2008). Siegel et al. (2010 [Fig. 15]), in a study of 51 fire areas 1–10 years old in the Sierra Nevada, also found that the probability of occupancy by black-backed woodpeckers was only about 14% even in the highest intensity fire areas with the highest levels of large snags. Since the majority of the burned area was dominated by low- and moderate-intensity fire effects, the average probability of black-backed woodpecker occupancy in fire areas in the Sierra Nevada was only about 8–9%, across all fire intensities and snag densities (Siegel et al. 2010 [Fig. 15]). Russell et al. (2007) found that abundance of black-backed woodpeckers in burned forests of the northern Rocky Mountains was positively associated with patch size, burn intensity, snag density, snag diameter, and pre-fire canopy cover. Thus, while small burns may act as stepping stones (*sensu* Hoyt and Hannon 2002) there may be a size and tree-density threshold: very small patches of intensely burned forests containing low densities of burned trees are not likely to be suitable habitat for black-backed woodpeckers.

In addition to overall population densities, nesting success of black-backed woodpeckers is correlated to fire intensity. Vierling et al. (2008) reported that nest density declined rapidly between year 2 and year 4 post-fire. Also, reproductive success was 80% in high-intensity patches, and was only 50% in moderately burned and 60% in low-intensity burned patches. In intensely burned boreal forests in Canada, black-backed woodpecker occupancy was more than twice as high in burned old forests than in burned young forests, and reproductive success was 84% and 73% in the first and second years post-fire, respectively, then declined to only 25% by the third year post-fire (Nappi and Drapeau 2009). Post-fire occupancy of black-backed woodpeckers is shorter in duration in the boreal forests of Canada, where trees are generally smaller, than it is in the conifer forests of the lower 48 states of the United States. Generally, post-fire occupancy of black-backed woodpeckers declines steeply in boreal forests after the second year post-fire (Murphy and Lehnhausen 1998, Nappi and Drapeau 2009), while post-fire occupancy declines steeply after the fifth year post-fire in conifer forests in Idaho (Saab et al. 2007), and after the third or fourth year post-fire in the Sierra Nevada at the scale of the fire area—i.e., the probability of *any* black-backed woodpecker occupancy in a given fire area as a whole (Siegel et al. 2010 [Fig. 15]). Therefore, not only do the number of black-backed woodpecker territories decline substantially within a few years post-fire, but also the reproductive success of the black-backed woodpeckers that do remain several years post-fire declines dramatically relative to the earlier post-fire years.

Saab et al. (2004) found that time since fire had a strong influence on occupancy of nest cavities for the black-backed woodpecker and other strong excavator bird species in two large fire sites in southwestern Idaho. Microhabitat features such as cavity orientation and location in the tree, tree height, and tree decay class were important determinants of nest cavity occupancy. From 2–3 years post-fire to 6 years post-fire, nest density declined by about 50%, and declined by about 75–80% by year 7 post-fire (Saab et al. 2004). From 4–5 years post-fire to 8 years post-fire, black-backed occupancy declines by about 75% (Saab et al. 2007). Hutto (1995) described black-backed habitat as becoming unsuitable or marginal after 6 years post-fire.

After continued nest monitoring of the unlogged burn in southwestern Idaho, Saab et al. (2007) studied nest densities of black-backed woodpecker from 1 to 10 years post-fire, and found that nest densities peaked at about 4–5 years post-fire.

In sum, results from studies throughout the range of *P. arcticus* conclude that densities (abundance per unit area) of nesting and foraging woodpeckers are greatest in mature and old-growth forests with high pre-disturbance canopy cover that were recently burned by high-intensity fire; densities decrease over time since disturbance; and nesting success varies by fire intensity and time since fire, with the highest nest success in forests very recently burned by high-intensity fire. Moreover, the presence of highly dense unburned old-growth forest may temporarily aid the persistence of black-backed woodpeckers during times of fire deficit, likely due to high numbers of snags in such forests.

Global Abundance and Population Trends—The black-backed woodpecker is rare even within its preferred habitat. While population irruptions and extensions outside resident ranges (e.g., Yunick 1985) can temporarily boost local populations, NatureServe (2009) notes that the black-backed woodpecker has most likely undergone range-wide declines over the 20^{th} century due to fire suppression and post-fire salvage logging, and loss of mature and old-growth forests. In an analysis of the North American Breeding Bird Survey (BBS), NatureServe indicates that the species is rarely detected, and there are few BBS survey routes in montane and northern boreal forests; thus only the broadest-scale trends can be estimated using BBS data. The BBS data from the period 1980 to 1996 (the most recent years available on the NatureServe website) show possible widespread declines, with a survey-wide decline of -4.9% per year ($P = 0.20$, $n = 49$) (sample size was likely too small to detect a statistically significant trend), and significant declines in Canada of -9.0% per year ($P = 0.04$, $n = 24$) and in the northern spruce-hardwoods physiographic region of -10.2% per year. Sample sizes from BBS data in other regions were too small for reliable trend estimates, though the population in California was designated as S3: "vulnerable."

Abundance and Population Trends in California—While a lack of reliable, long-term, range-wide surveys and banding studies has resulted in a dearth of information on abundance and population trend of the black-backed woodpecker in California, comparison of historical accounts of greater abundance with recent observations, as well as analyses of loss of suitable habitat, indicate the species has likely declined substantially over the past century in the state.

Observational data indicate that *P. arcticus* was once relatively common in the 19th century in the state, prior to widespread fire suppression and post-fire salvage logging. Early accounts of the species report the bird to be "numerous" in the Sierra Nevada. In 1870, Dr. Cooper reported in his "Ornithology of California" (at p. 348):

> "I found the bird quite numerous about Lake Tahoe, and the summits of the Sierra Nevada above six thousand feet altitude, in September, and it extends thence northward, chiefly on the east side of these and the Cascade Mountains, as I never saw it near the Lower Columbia. At the lake [Tahoe] they were quite fearless, coming close to the hotel, and industriously tapping the trees in the early morning and evening. In the North I found them very wild probably because the Indians pursue them for their scalps, which they consider very valuable…."

Just 50 years later, Dawson (1923) noted (at p. 1,006) that "I have never seen the bird myself, though I have searched diligently for him in the Warner Mountains, on Shasta, and in various localities of the central southern Sierras." Similarly, Grinnell and Miller (1944, at p. 248) noted that the black-backed woodpecker was "[s]carce generally; fairly common in but a few places." By the 1970s, the black-backed woodpecker was considered rare. Small (1974, at p. 98) described the species as an "[u]ncommon to rare resident." These descriptions were in stark contrast to Cooper's observations in the previous century.

Siegel et al. (2008) designed and tested field methods for developing a monitoring program for black-backed woodpecker occupancy on Sierra Nevada national forests. The authors used passive point counts followed by playback of black-backed vocalizations at survey stations within 17 randomly selected fire areas ($n = 371$ surveys) throughout the Sierra Nevada. Stations where black-backed woodpeckers were located were distributed from the Lassen National Forest to the Sequoia National Forest, as well as at sites west and east of the Sierra crest, but in only about 50% of recent fire areas overall. In an expanded version of the study, Siegel et al. (2010) surveyed 51 fire areas that had high-intensity fire patches, 1–10 years post-fire, throughout the Sierra Nevada management region (including the Warner Mountains in the Modoc National Forest), and found black-backed woodpeckers in only 28 of these 51 fire areas. This indicates that, while black-backed woodpeckers persist in the southern, central, and northern portions of the Sierra Nevada management area (Siegel et al. 2008), the species is poorly distributed *within* its range, given current low black-backed woodpecker populations levels, dramatic declines in the spatial abundance and distribution of suitable habitat since the onset of fire suppression and logging, current significant spatial gaps between habitat areas due to ongoing fire suppression and post-fire logging, and limited black-backed woodpecker dispersal distances (Hoyt and Hannon 2002), as discussed below. It is a significant conservation concern that so few patches of occupied black-backed woodpecker habitat exist in the entire Sierra Nevada management region, which includes nearly all of the black-backed woodpecker's range in California.

In Siegel et al. (2008), black-backeds were detected in burned areas within major conifer forest types, including eastside pine, Jeffrey pine, Jeffrey pine/red fir, and Sierra mixed conifer (Siegel et al. 2008 and **Appendix A**, attached hereto) (one small fire, Bassetts, was categorized as subalpine, but was actually upper montane forest ~ 1,800 m in elevation). Occupied sites ranged from small fires such as the Vista Fire (170 ha burned) and Rock Creek fire (187 ha burned) to very large fires such as the Moonlight Fire (26,159 ha burned). Black-backed woodpeckers were detected in 27% of burned area survey stations (55 of 202) at 1–5 years post-fire, but were found in only 8% of burned area survey stations (13 of 169) by 6–7 years post-fire (Siegel et al. 2008, see **Appendix A** attached). Black-backeds were detected at 7.8% of stations classified as low-severity burned, 17.2% classified as mid-severity burned, and 25.2% classified as "high-severity" burned (Figure 6). Thus, while occupancy was not correlated to conifer forest type or fire size (170–>26,000 ha), black-backed woodpeckers were detected most often in stands that experienced higher-intensity fire.

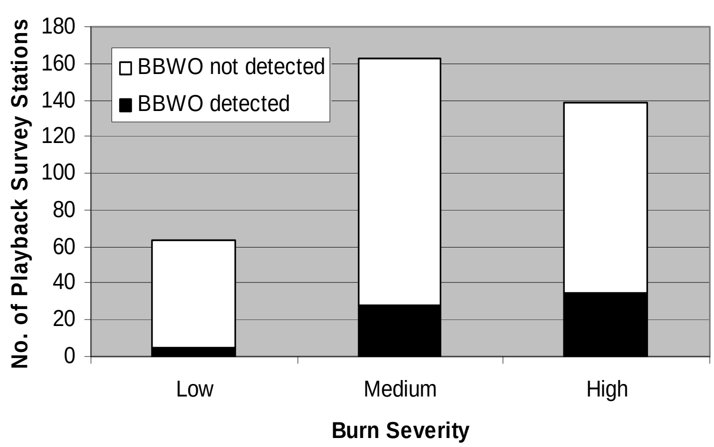

Figure 6. Number of fire areas of each age where black-backed woodpeckers were detected or not detected during playback surveys in 17 fires on Sierra Nevada national forests in 2008. From Siegel et al. (2008 at p. 32).

Appendix A documents the national forest, name, age, size, and dominant pre-fire habitat of the fires surveyed by Siegel et al. in 2008, the number of stations at which playback surveys were conducted, and the number black-backed woodpeckers detected at each station.

Siegel et al. (2010 [Fig. 15]), surveyed 51 fire areas 1–10 years post-fire, representing the great majority of all burned conifer forest in the Sierra Nevada management region in fires with at least one large high-intensity fire area. Based upon the statistical analysis of occupancy conducted by Siegel et al. (2010), the authors determined that the probability of black-backed woodpecker occupancy is very low in the southernmost portion of the Sierra Nevada, and at lower elevations (Siegel et al. 2010 [Fig. 15]). Siegel et al. (2010 [Fig. 15]) determined that, even in the areas of highest fire intensity and highest levels of snags, the probability of black-backed woodpecker occupancy in the Sierra Nevada is only about 14%, and that the overall/average probability of occupancy in fire areas is only about 8–10%. These results from the Sierra Nevada were similar to studies in other regions (e.g., Hutto 2008 in the Rocky Mountains) indicating that the species is rare even in its favored habitat.

In 36 study sites across three fire areas in the Sierra Nevada, Hanson and North (2008) found black-backed woodpeckers only in dense, mature/old-growth forest that burned at high intensity and had not been salvage logged. None were found in unburned, moderate intensity, or salvage logged sites (Hanson and North 2008). The detection of black-backeds in some moderate intensity areas in studies using the playback method (in which a recording of a black-backed call is played loudly to attract the birds) may in part be the result of attracting the birds from adjacent high-intensity areas. For example, Siegel et al. (2008) noted that, because the "playback methodology lured birds towards the observers", their data "do not permit a definitive assessment of the species' affinity for habitat burned at various severities."

There are several major difficulties with estimating abundance and population trend of black-backed woodpeckers in California. The first is the ephemeral and unpredictable nature of its habitat. Post-disturbance habitat remains suitable for only a limited period of time, as the abundant food resources (wood-boring bark beetles) attracted to the natural disturbance first peak and then begin to wane in the years following fire or insect infestation. High-quality burned forest habitat remains suitable for 4–5 years post-fire, but declines rapidly in suitability thereafter. Another complication in estimating abundance and population trend is that not every patch of intensely burned forest that may appear suitable is occupied by black-backed woodpeckers.

For the purposes of this CESA petition, we estimated the current abundance of black-backed woodpeckers in suitable habitat in California based upon the best available science. We used two different methods, based upon the following criteria, to develop an estimate of abundance based on the amount of suitable habitat through 2009.

<u>Method 1</u>

1. Black-backed woodpeckers select intensely burned mature/old-growth conifer forests with moderate to high pre-fire crown cover and high densities of trees, preferring to forage on larger-sized dead or decadent trees and nest in medium-sized trees (Hanson 2007, Russell et al. 2007, Hanson and North 2008, Vierling et

al. 2008). Moderate to high quality habitat equates to CWHR (California Wildlife Habitat Relationships) 4M, 4D, 5M, 5D and 6 habitat (old forest) burned at high intensity (note: size class 4 = trees averaging 11–24 inches dbh; size class 5 = trees averaging > 24 inches dbh; canopy cover M = 40–60% cover; canopy cover D is cover > 60%). To be conservative, we also included moderate-intensity fire areas, even though much of this is likely marginal habitat. The black-backed's range in California coincides with the area analyzed under the Sierra Nevada Ecosystem Project Report (which includes the Sierra Nevada and southern Cascades, up to the Oregon border), except that black-backeds do not exist south of the Lake Isabella area in the southern portion of Sequoia National Forest. Moreover, black-backeds essentially do not use lower montane forests or pinyon/juniper (Siegel et al. 2010), so we excluded these forests using CalVeg GIS layers. We used these foregoing parameters to define our analysis area.

2. Salvage-logged burned stands are not suitable habitat (Hutto and Gallo 2006, Hanson and North 2008). We excluded private lands since essentially all black-backed habitat is rapidly clearcut on private timberlands under current laws (see below). We also excluded the estimated portions of national forest lands that have been salvage logged.

3. Studies of black-backed woodpecker nest density in unlogged, recently burned forests indicate a density of about 0.80 pairs per 100 ha (about one pair for every 300 acres) at 1–6 years post-fire. To be very conservative, we also included 7–10 year-old fire areas, which have about 0.25 pairs per 100 ha (about one pair for every 1,000 acres), though in reality much of this is marginal since too many years have passed since the fire (see Table 6 above). This is consistent with the degree of decline in black-backed occupancy with time since fire reported by Siegel et al. (2010 [Fig. 15]). We used these densities for our estimate.

4. We used an RdNBR fire intensity threshold of 800 to define high intensity. This is conservative, as it equates to only about 60% mortality of overstory trees (trees > 50 cm dbh, i.e., the size selected by black-backeds in Hanson 2007) in mature stands (Hanson et al. 2010). High intensity is typically defined as equating to at least 75% mortality of overstory trees (Schwind 2008). To be conservative, we also included moderate intensity areas with RdNBR values of 574–799. An RdNBR value of 574 equates to only about 40% mortality of overstory trees >50 cm dbh (Hanson et al. 2010).

This analysis yields a total of 15,079 ha of highly suitable black-backed habitat currently in existence in California <u>before salvage logged areas on national forest lands are excluded</u>. This pertains to the most suitable areas, i.e., high-intensity areas 1–6 years post-fire (Figure 7 below depicts the locations of high-intensity patches within areas of suitable pre-fire CWHR habitat for fires 2003–2008 before any logging on national forests occurred; there was less than 300 ha of this habitat created in 2003 or in 2009, so this map essentially represents 2004–2009 as well). Including moderate-intensity areas 1–6 years post-fire adds another 6,635 ha of black-backed woodpecker habitat. Including the high-intensity and moderate-intensity fire areas yields 21,714 ha of suitable habitat. Of this amount, 12,694 ha are within a single fire area on the Plumas National Forest (with a small portion on the Lassen National Forest): the Moonlight/Wheeler fire area of 2007. A conservatively estimated 1,000 ha of the suitable habitat on the Moonlight/Wheeler fire area was salvage logged in 2008 in the Wheeler portion through several roadside "hazard" tree removal projects and one regular salvage logging project (USDA 2009a [Moonlight/Wheeler RFEIS]). An additional 5,000+ ha of suitable habitat was logged to date in 2009/2010, or is currently being logged, in the Moonlight portion of the fire area (USDA 2009a [Moonlight/Wheeler RFEIS]). The second-largest block of suitable habitat is within the Power fire of 2004 on the Eldorado National Forest, amounting to 1,183 ha. Over half of the high-intensity burned area was salvage logged in this fire (*Earth Island Institute v. U.S. Forest Service*, 442 F.3d 1147 (9th Cir. 2006)), thus we conservatively estimate that 591 ha of suitable habitat was logged. The third-largest block of suitable habitat is within the American River Complex fire of 2008 on the Tahoe National Forest, amounting to 907 ha. Over 200 ha of this area is proposed for salvage logging currently (USDA 2009b [Black Fork salvage logging EA]). The fourth-largest block of suitable habitat was within the Freds fire of 2004 on the Eldorado National Forest, amounting to 556 ha. Well over 90% of the high-intensity burned area was salvage logged in this fire (*Earth Island Institute v. U.S. Forest Service*, 442 F.3d 1147 (9th Cir. 2006)), thus we conservatively estimate that 500 ha of suitable habitat was logged. Several other smaller patches of suitable habitat have also been salvage logged, but no reliable estimates exist.

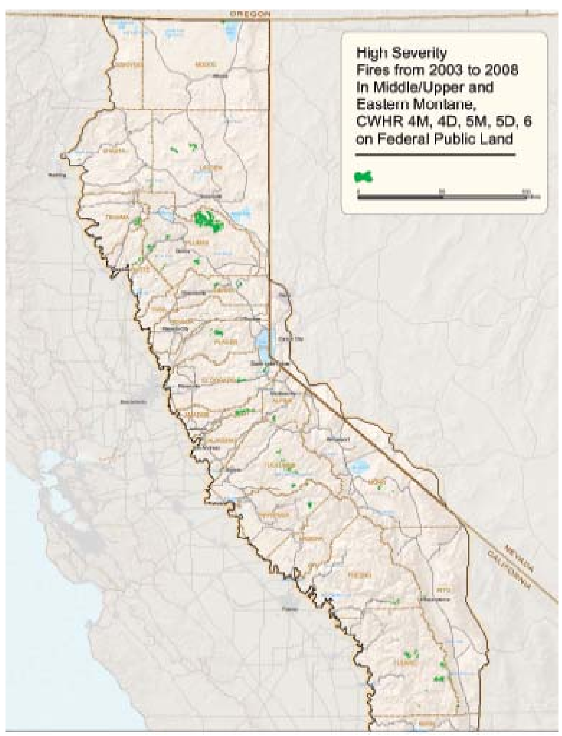

Figure 7: Current amount of high quality suitable habitat for black-backed woodpeckers in California.

Very conservatively, then, of the 21,714 ha of suitable black-backed habitat described above, at least 7,291 ha have already been salvage logged or are currently being logged (and many additional areas are currently proposed for salvage logging, but no decision has yet been made), leaving 14,423 ha of suitable habitat. Of this amount, only about 21% is in protected lands such as National Parks, Wilderness Areas, or Inventoried Roadless Areas. At 0.8 pairs per 100 ha, this amount of habitat equates to only about 115 pairs of black-backed woodpeckers in California within highly suitable habitat.

If older fire areas are included, this represents an additional 18,424 ha which, at approximately 0.25 pairs per 100 ha for areas 7–10 years post-fire, potentially equates to an additional 46 pairs of black-backed woodpeckers. However, most of this acreage is represented by two large fire areas in the southern portion of Sequoia National Forest, the Manter fire of 2000 and the McNally fire of 2002, where Siegel et al. (2010) found no black-backed woodpeckers remaining as of 2009; thus, these older fires likely represent even fewer pairs of black-backeds.

All told, then, this method estimates only about 161 pairs of black-backed woodpeckers within the 32,847 ha of moderately to highly suitable habitat in California's forests currently (though, as discussed above, some of this is likely low suitability).

Even if we also included marginal habitat with RdNBR values 500–574 (RdNBR of 500 corresponds to only 21% mortality of trees >50 cm dbh, using the same methods used in Hanson et al. 2010), it would add only another 3,613 ha. Even if we used the unusually high nest density estimate of approximately 1.6 nests per 100 ha for the most recent fires from the 2010 survey by Burnett (pers. comm. 2010), described above in "**Factors Influencing Abundance and Population Trend**," this still only yields a total of less than 16,000 ha of black-backed habitat in fires 1–6 years old, and only about 256 pairs of black-backed woodpeckers in these fires. Burnett (pers. comm. 2010) found zero nests in the 8-year-old and 9-year-old fire; however, using the estimate from Siegel et al. (2010) for occupancy decline over time, fires 7–10 years old have black-backed occupancy rates about 80–90% lower than more recent fires, which would equate to nest densities of about 0.24 nests per 100 ha—nearly identical to the figure of 0.25 pairs per 100 ha reported in Saab et al. (2007) for areas 7–10 years post-fire, and used above. Applying this nest density figure to the areas 7–10 years post-fire (18,424 ha) yields only another 44 pairs of black-backed woodpeckers. ***Thus, even in the most optimistic scenario, there are only about 300 pairs of black-backed woodpeckers in California*** within suitable habitat.

Method 2

In this method, abundance of black-backed woodpeckers is estimated simply by using the acreage estimate for all fires (all fire intensities included) in montane conifer forest (all pre-fire forest ages, densities and structures included) on public lands within the black-backed's range in California over the past 10 years, 176,504 ha, and the probability of occupancy figures reported in Fig. 15 of Siegel et al. (2010) for average fire conditions (i.e., neither the highest nor the lowest fire intensities or snag densities), about 8–10%.

We can then estimate that about 15,885 ha of these fire areas are occupied by black-backed woodpeckers. Even if we used the unusually high nest density figures of approximately 1.6 nests per 100 ha for the most recent fires from the 2010 survey by Burnett (pers. comm. 2010), described above in "**Factors Influencing Abundance and Population Trend**," this still equates to only about 254 pairs of black-backed woodpeckers in California in all fire areas within the black-backed's range in the state. It must be noted, however, that this would likely be an overestimate, since it is based only upon nest density figures for very recent fires (i.e., at peak density), and does not include nest density figures for the first year of Burnett's data collection (2009), which found much lower black-backed nest density, as discussed above. Burnett's nest density data yielded zero nests in the 10-year-old fire. Also, given that black-backed occupancy outside of fire perimeters is more than 50 times lower than it is within fire areas (Hutto 2008), only a negligible additional number of pairs would be expected outside of fires, and survival and reproductive success would be far lower in this unsuitable habitat as well, as discussed above.

All told, then, there are only about 161 to 300 pairs of black-backed woodpeckers in California, including both suitable and marginal habitats. At such extremely low numbers, combined with the highly fragmented nature of the population (total population of less than 2,500 and zero subpopulations [individual or aggregate fire areas] with more than 500 individuals), the black-backed woodpecker fits the definition of "endangered" in California (Mace and Lande 1991). More recent research indicates that several thousand individuals (approximately 5,000) are needed to prevent a significant risk of extinction (Traill et al. 2007, Traill et al. 2009). Black-backed woodpecker populations in California fall far, far below this threshold.

Siegel et al. (2010) used a method similar to Method 2 described immediately above in order to approximately estimate the number of black-backed woodpecker pairs in the Sierra Nevada management region (which includes essentially all of the black-backed's range in California), and, like our estimates above, Siegel et al. (2010) estimated a number of pairs far below the levels identified in Mace and Lande (1991) and Traill et al. (2007, 2009) at which a significant risk of extinction occurs. Estimates of Siegel et al. (2010) were somewhat higher than estimates from our Method 1 and Method 2 above because Siegel et al. (2010) mistakenly used the 25% occupancy figure from their raw data, rather than the corrected figure of less than 10% average probability of occupancy from their statistical analysis (see Fig. 15 from Siegel et al. 2010), which skewed the estimate high. An additional problem is that Siegel et al. (2010) used the callback method with only a 250-meter separation of data points, as discussed above, equating to less than 20 ha per survey station (250-meter radius is a little less than 20 ha) for a species with a home range many times larger than this. In other words, the same bird/s in a given territory would have been lured by the callback sounds multiple times at multiple survey stations within a given black-backed territory, leading to double- and triple-counting of the same individual, if only the raw, unanalyzed data are used (Siegel et al. 2008 noted that this was a potential risk). Moreover, the estimate in Siegel et al. (2010) used three home-range size estimates to derive a range of possible black-backed pair abundance, but the one of these that led to the highest estimate of pair abundance, Lisi

(1988), is an unpublished, apparently anecdotal account which cannot be verified in any way, and which was conducted in Vermont, where forest conditions are substantially different from those in California.

Our Method 1 and Method 2 estimates of black-backed woodpecker abundance in California, described above, are conservative, and the current circumstance could be significantly worse, given that there has thus far been almost no wildland fire in montane conifer forests within the black-backed woodpecker's range in California in 2010.

A series of maps illustrating the highly specific nature of black-backed woodpecker habitat is found in **Appendix B** attached hereto, with each successive restriction approaching progressively closer to actual estimates of high quality suitable habitat. The second to final map shows suitable black-backed habitat BEFORE salvage logging on national forests is excluded (we could not provide a map showing suitable habitat after salvage logging on national forests since no GIS layers exist for this logging). The final map shows suitable habitat further restricted by excluding patches of suitable habitat less than 12 ha (Saab et al. 2002), but BEFORE salvage logging on national forests is excluded (again, to be conservative, we did NOT exclude patches of suitable habitat less than 12 ha in our analysis of the amount of habitat acres, and black-backed populations, described immediately above).

Further, our methodology is consistent with the description of suitable habitat in a scientific literature review recently sent to the U.S. Forest Service (Hutto and Hanson 2009, attached hereto as **Appendix C**).

To put the current extremely low amount of black-backed woodpecker habitat in perspective, we now estimate the relative amount of black-backed habitat that existed prior to fire suppression and logging. As discussed in detail in the sections below, historically there was 2–4 times more high-intensity fire than there is now—i.e., on average, in a given decade, high-intensity fire would spatially affect 2 to 4 times more forest area than is does currently. Further, there was 4–8 times more old forest historically than there is now, as discussed below. In other words, we now have one-half to one-fourth the amount of high-intensity fire, and one-fourth to one-eighth the amount of old forest, that existed prior to fire suppression and logging. Since optimal black-backed woodpecker habitat is the convergence of high-intensity fire and old forest, as discussed above, less than one-eighth of the historic amount of high quality black-backed woodpecker habitat now exists across the landscape in the Sierra Nevada. If even one-third of this suitable black-backed woodpecker habitat is salvage logged, which is an extremely conservative assumption (see below), then this deficit of black-backed woodpecker habitat, relative to historic conditions, is exacerbated even further.

Indeed, it comes as no surprise that the black-backed woodpecker that was once described as "quite numerous" in the Sierra Nevada in 1870 (Cooper 1870), is now extremely rare.

FACTORS AFFECTING ABILITY OF THE POPULATION TO SURVIVE AND REPRODUCE

I. PREDATION

Predation was the leading cause of nest loss (89%) of black-backed woodpecker nestlings in 44 nests in beetle-killed forests in the Black Hills, South Dakota (Bonnot et al. 2008). Vierling et al. (2008) examined post-fire reproductive success in burned forests in the Black Hills for 1–4 years after fire. Predation was the major cause of nest failure of all 7 species of woodpecker and increased between 2–4 years post-fire, to the end of the study. Predation caused 27% of nest failures 2 years post-fire, 61% the third year, and 67% 4 years after fire. Saab et al. (2004) report that small mammalian and reptilian nest predators commonly observed in or near their study site in southwestern Idaho included red squirrels (*Tamiasciurus hudsonicus*), weasels (*Mustela* spp.) and bullsnakes (*Pituophis melanoleucus*). Chickarees (*Tamiasciurus douglasi*) were suspected predators of eggs and nestlings in unlogged forests of Oregon (Goggans et al. 1988 as cited in Dixon and Saab 2000).

Little information is available regarding predation of adult black-backed woodpeckers. One adult male with a backpack radio was found killed by a Cooper's hawk (*Accipiter cooperii*; Dixon and Saab 2000).

II. COMPETITION AND DISEASE

Non-predatory interspecific interactions have been observed around black-backed woodpecker nest sites, particularly between black-backeds and other cavity nesters (Dixon and Saab 2000). Mountain bluebirds, western bluebirds (*S. mexicana*), white-headed woodpeckers (*P. albolarvatus*), and hairy woodpeckers showed aggression towards black-backed woodpeckers (Dixon and Saab 2000). Black-backed woodpeckers were displaced on 4 observed occasions by a white-headed woodpecker, a hairy woodpecker, a western bluebird, and a mountain bluebird. On one occasion, a newly excavated black-backed cavity was taken over by a Lewis's woodpecker (*Melanerpes lewis*). Villard and Beninger (1993) found that of 22 interspecific contacts, individual black-backed woodpeckers always moved to a new tree when individual hairy woodpeckers approached. Hairy woodpeckers were then seen foraging at or near the same place black-backed woodpeckers had been foraging.

No information currently is available regarding disease or parasites of black-backed woodpeckers (Dixon and Saab 2000).

III. EPHEMERAL NATURE OF HABITAT

Black-backed woodpecker habitat is created by high-intensity fire (and large-scale insect outbreaks that kill most of the trees across large areas of dense mature forest could potentially be suitable as well, though no such areas are known to exist currently within the black-backed's range in California). The very nature of these disturbances results in a supply of suitable habitat that is highly unpredictable and ephemeral. Habitat must be replaced over time to support breeding of woodpeckers and other cavity-nesting birds. Fire-killed trees only support a certain number of generations of wood-boring beetles and bark beetles before populations of beetle larvae (the black-backed's food source) begin to steeply decline (Dixon and Saab 2000). Although the length of time since fire that an area remains suitable varies by site depending on size, intensity, and landscape patterns of the burn (Saab et al. 2004, Saab et al. 2007), the optimal habitat for the species based on research regarding available food resources, number of individuals, number of breeding pairs, and nest success is mature and old-growth forest with high pre-fire canopy and high densities of trees of all sizes that recently (i.e., 1–4 years prior) burned at high intensity.

Studies of black-backed woodpecker numbers over time indicate that burned forests represent critical but only temporarily suitable habitat. Murphy and Lehnhausen (1998) found black-backed woodpeckers common 2 years after fire in interior Alaska, but by the third year were rare and had left the area by the fourth year post-fire. Saab et al. (2004) and Saab et al. (2007) found that black-backed occupancy declined steeply after about 3–5 years post-fire, and Siegel et al. (2010 [Fig. 15]) found the same in California.

In addition to overall abundance, nest densities decline over time. Saab et al. (2002, 2004, 2007) found that time since fire had the greatest influence on occupancy of nest cavities for the black-backed woodpecker—nest densities peaked at about 3–5 years post-fire—and postulated that mammalian and reptilian nest predators begin to recolonize a burned site over time. The fire at one of their study sites was much larger in extent and burned at greater intensity than the other, and nest predators took 2 years longer to recolonize this site.

The black-backed woodpecker is more strongly tied to intensely burned forests than perhaps any other bird species. The rarity of the black-backed woodpecker in unburned forests suggests that these forests represent sink habitats. Unburned forests may allow the species to temporarily persist but the population of black-backeds will inevitably decline unless intensely burned forest and its associated abundance of food resources and lower predation levels once again becomes available (Murphy and Lehnhausen 1998). In other words, the persistence of black-back woodpeckers in California is likely dependent upon maintaining a patchwork of intensely burned forests of large enough size, containing sufficiently high densities of small to large dead trees, where these patches are constantly replenished over time.

A recent paper by Hutto (2008) explored the ecological relationship between black-backed woodpeckers and intensely burned forests, and investigated the implications of an avian species that evolved to depend upon high-intensity fire to our current beliefs about the pre-historical prevalence of this disturbance. Hutto (2008) noted on p. 1,831 that "[n]o other bird that occupies conifer forests is as specialized on such a small subset of forest types or conditions…This bird species was also relatively restricted in its distribution…to the severely burned end of the fire severity spectrum." Hutto further stated on p. 1,828 that "[e]xtreme specialization by an organism can evolve only if the particular conditions to which it is adapted were sufficiently abundant during its speciation, which for most bird species occurred millions of years ago." In other words, the black-backed woodpecker would not have evolved in tandem with high-intensity fire without a sufficient degree and frequency of this type of habitat disturbance during its evolutionary history.

Dr. Hutto further stated:

> "Nevertheless, the pattern of occurrence might not reflect the pattern of habitat suitability—a possibility that Van Horne (1983) highlighted more than 2 decades ago. A mismatch between density (frequency of occurrence) and suitability is perhaps most likely when animals use unnatural, human-altered habitats. It is in those situations that humans run the greatest risk of creating an ecological trap—an attractive habitat that is otherwise relatively unsuitable (Robertson and Hutto 2006). Under naturally occurring conditions, however, it is unlikely that a place where an organism is 16 times more likely to occur than anywhere else is of relatively low quality. It is this, combined with knowledge that the reproductive success of black-backed woodpeckers is uniformly high in burned forests (Saab and Dudley 1998; Saab et al. 2007; Vierling et al. 2008), that leads me to believe that burned forests are important to these birds. Thus, the extremely restricted distribution pattern of the black-backed woodpecker suggests that conditions created by severe fire probably represent the historical backdrop against which this species evolved…
>
> "The black-backed woodpecker may use severely burned, low-elevation forests entirely opportunistically nowadays as an 'unnatural' consequence of the fact that fires are now burning at unnaturally high severity, but it is noteworthy that its probability of occurrence is no different among forest types. To believe that only one or a few forest types burned severely in the past, and that the other forest types are today occupied only opportunistically would require a convergence of all factors necessary not only for woodpecker presence, but for a high level of nest success as well. *I find it much more likely that severe fires were important components in all the forest types now occupied by the woodpeckers*."
>
> pp. 1,831–1,832; emphasis added.

In other words, the fact that black-backed woodpeckers occur at the greatest densities in intensely burned coniferous forests, that nesting success is highest in these habitat types, and that early accounts report the species as "numerous" in the Sierra Nevada prior to fire suppression and "rare" after fire-suppression and post-fire salvage logging began in earnest, strongly suggests that intense fires and the resulting standing dead trees to which wood-boring beetles are attracted were historically, and are currently, an important part of forest dynamics in the range of the species in California.

A common misperception of many forest managers is that the frequency and extent of high-intensity fire in California is greater now than during the period of pre-European settlement. This misperception has led to widespread efforts to prevent high-intensity fire, to suppress fires when they do burn, and to remove recently burned snag forests and replant the area.

The black-backed woodpecker depends upon a constantly replenished supply of intensely burned forest that contains high densities of medium and large dead trees. This habitat apparently occurred with enough frequency to support the species throughout its evolutionary history in North America, including in California. Over the past century, however, its favored habitat has been methodically and systematically eliminated by fire suppression and post-fire salvage logging (see discussion below), to the point where intensely burned mature and old-growth receives no regulatory protection whatsoever. In fact current policies governing post-fire forest management on both private and public lands actively encourage the removal of the burned habitat that black-backed woodpeckers depend upon for survival as part of “post-fire restoration.” As a result, the black-backed woodpecker population in California has declined from “numerous” to “rare.” If old-forest habitats are not protected, if such habitats are prevented from burning intensely, and if intensely burned old-growth forests are not permitted to remain standing, the black-backed woodpecker will continue to be threatened with extinction.

NATURE, DEGREE, AND IMMEDIACY OF THREATS

Black-backed woodpecker habitat is directly eliminated and indirectly reduced or degraded by management actions that are widely conducted on public and private forests throughout the range of the species. Habitat is systematically lost through post-fire salvage logging, active fire suppression, and pre-fire thinning to reduce fire risk. Saab et al. (2007) pointed out that while migrant species evolved under highly variable conditions, residents such as black-backed woodpeckers are more vulnerable to habitat changes created by salvage logging. Therefore, black-backed woodpeckers are especially vulnerable to population declines from logging projects that remove the habitat upon which they depend for survival (Hutto 1995, Dixon and Saab 2000, Hoyt and Hannon 2002, Saab et al. 2007, Hutto 2008, Hanson and North 2008). Unfortunately, current management prescriptions in black-backed woodpecker habitat do not offer sufficient protection to prevent further declines of the species in California and elsewhere (Hanson 2007, Hanson and North 2008), and future climate changes may further reduce habitat availability.

I. POST-FIRE SALVAGE LOGGING

Black-backed woodpeckers are vulnerable to local and regional extinction as a result of post-fire salvage logging (Dixon and Saab 2000). Post-fire logging of burned trees is perhaps the most important and most well-documented threat to the persistence of black-backed woodpeckers in California and throughout the range of the species. Every study ever conducted examining the effects of salvage logging on black-backed woodpeckers has documented significant declines in abundance and nest densities in burned logged forests as compared to burned unlogged forests. Nearly 15 years ago, scientists began warning that post-fire salvage logging was eliminating crucial habitat not only for black-backed woodpeckers but also for a number of other fire-dependent wildlife species. In 1995, Dr. Richard Hutto of the University of Montana and the Rocky Mountain Research Station of the U.S. Forest Service (1995 at p. 1,053) pointed out that logging methods that "tend to 'homogenize' the stand structure (such as selective removal of all trees of a certain size and/or species) will probably not maintain the variety of microhabitats and, therefore, bird species that would otherwise use the site. Selective tree removal also generally results in removal of the very tree species and sizes preferred by the more fire-dependent birds."

Dr. Hutto further stated at p. 1,054 that "[f]ire (and its aftermath) should be seen for what it is: a natural process that creates and maintains much of the variety and biological diversity…Most current cutting practices neither create large amounts of standing dead timber nor allow forests to cycle through stages of early succession that are physiognomically similar to those that follow stand-replacement fires." In other words, post-fire salvage logging does not mimic natural processes that create the burned habitat critical for black-backed woodpeckers. Murphy and Lehnhausen (1998) also noted that salvage logging is particularly detrimental to black-backed woodpeckers because it forces the birds to persist in undisturbed forests where their densities are much lower. The authors stated at p. 1,370 that "[b]oth fire suppression and salvage logging after fires will prolong periods of use of unburned [spruce] forests by black-backed woodpeckers and likely will cause black-backed woodpeckers to decline."

Nest densities as well as overall abundance of black-backed woodpeckers are adversely impacted by post-fire salvage logging. Saab and Dudley (1998) followed 17 black-backed woodpecker nests from 1994 to 1996 in forests of western Idaho that burned in 1992 and 1994. Nest densities were more than quadrupled in unlogged stands versus both "standard salvage" and "wildlife salvage" treatments, despite significant snag retention. Additional nest monitoring was conducted over subsequent years in the same study site. Saab et al. (2007) reported that nest densities were more than 5 times lower in partially logged burns: 43 nests (29 early, 14 late) were detected in unlogged stands and 8 nests (5 early, 3 late) were detected in logged stands. In the logged treatment, pre-harvest snag densities were 73.4 ± 9.3 snags >23cm/ha, and after logging were 45 ± 5.1 snags >23cm/ha and 129.6 ± 19.8 snags ≤23cm/ha. The unlogged burned stands had 67.8 ± 11.5 snags >23cm/ha and 100.4 ± 19.7 snags <23cm/ha. Numbers of nesting black-backed woodpeckers were significantly reduced in burned, logged stands compared to burned, unlogged stands elsewhere in the Rocky Mountains as well (Harris 1982 and Caton 1996 as cited in Dixon and Saab 2000). In the eastern Oregon Cascades, Cahall and Hayes (2009) found that partial salvage logging did not mitigate adverse effects to black-backeds.

Hutto and Gallo (2006) examined nest densities in burned mixed-conifer forest in Montana and found numerous black-backed nests in unlogged moderate- and high-intensity burned areas but 0 nests per 275 ha in salvage-logged stands. Other cavity-nesting avian species are negatively impacted by the decrease in black-backed woodpecker abundance due to salvage logging because black-backeds are primary cavity excavators. Hutto and Gallo (2006) found that the frequency of cavity re-use by cavity nesters was higher in salvage-logged than in unlogged plots, possibly reflecting a greater level of nest-site limitation in the salvage-logged areas. The authors noted at p. 829 that "[i]n unlogged areas, the continuous creation of roosting and nesting cavities by primary cavity-nesting species may provide abundant new cavities for secondary cavity-nesting birds to use. In contrast, fewer breeding primary cavity-nesters in salvage-logged areas create fewer new cavities, and this may force secondary cavity-nesting birds to reuse a smaller number of older cavities, which could also affect their nest success in salvage-logged forests."

Hanson and North (2008) investigated whether current management prescriptions for salvage logging in the Sierra Nevada, involving removal of all but 7.5–15 large (≥50 cm) snags/ha in intensely burned forest, could reduce foraging habitat quality for black-backed woodpeckers. The authors surveyed for the species in 3 large fire sites using point counts in unburned (n = 9), moderate-intensity/unlogged (n = 8), high-intensity/unlogged (n = 10), and high-intensity/logged (n = 9) plots, including only patches >12 ha within a given burn category. The density of small/medium-sized snags (25–49 cm) was greatest in high-intensity/logged and high-intensity/unlogged plots, and the density of large (≥50 cm) snags was greatest in high-intensity/unlogged and lowest in high-intensity/logged plots and unburned plots. Some additional snags beyond the minimum retention levels were deemed unmerchantable and retained. Black-backed woodpeckers were found foraging *exclusively* in high-intensity/unlogged patches in this study, and they selectively foraged on large snags more than would be expected based upon availability (Hanson 2007). The fire-affected stands surveyed by Hanson and North (2008) were all heavily burned and thus it is likely that detectability was similar between all burned plots.

Most (97%) of foraging observations by Hanson and North (2008) occurred on snags as opposed to live trees. Even with above-minimum levels of large-snag retention due to the unmerchantability of some snags, foraging was significantly reduced for the black-backed woodpecker in logged plots. Hanson and North (2008) did not find black-backed woodpeckers foraging in the high-intensity/logged condition despite high density of small snags—a characteristic that has been used to describe habitat in the immediate vicinity of black-backed nest trees in the Rocky Mountains (Saab et al. 2002). The authors concurred with Dr. Richard Hutto that the black-backed woodpecker's preference for foraging in high-density, intensely burned forest, and historical records indicating that this rare species was once common, suggests that high-intensity burns occurred with enough frequency for this species to evolve a strong association with them.

Hutto (2006) explained that post-fire snag-management guidelines currently in use by the U.S. Forest Service and other government agencies have failed to embrace the science on the value of intensely burned forest habitat. Dr. Hutto's eloquent words best describe the dire situation faced by fire-dependent species today:

> "The naturalness and importance of crown fires is reinforced by the fact that the bird species that are always more common in burned than in unburned forests are also more common in the more severely than in the less severely burned portions of those forests. The dramatic positive response of so many plant and animal species to severe fire and the absence of such responses to low-severity fire in conifer forests throughout the US West argue strongly against the idea that severe fires are unnatural. The biological uniqueness associated with severe fires could emerge only from a long evolutionary history between a severe-fire environment and the organisms that have become relatively restricted in distribution to such fires. The retention of those unique qualities associated with severely burned forest should, therefore, be of highest importance in management circles. Yet, everything from the system of fire-regime classification, to a preoccupation with the destructive aspects of fire, to the misapplication of snag-management guidelines have led us to ignore the obvious: we need to retain the very elements that give rise to much of the biological uniqueness of a burned forest – the standing dead trees." p. 987.
>
> "Unfortunately, we have generally failed to adjust snag-retention recommendations to specific forest age, and nowhere is that failure more serious than for those special plant community types that were ignored in

the development of the generic guidelines – recently burned conifer forests. Such forests are characterized by uniquely high densities of snags, and snag use by most woodpeckers in burned forests requires high snag densities because they nest in and feed from burned snags." p. 989.

"The numbers of standing dead trees per hectare immediately following stand-replacement fire number in the hundreds, of course, so snag guidelines should recommend perhaps 50 times the number currently recommended in the most commonly used guidelines. On top of that, the densities of snags in patches used by birds for cavity nesting are significantly higher than what is randomly available in early postfire forests, so even if guidelines were built on 'average' snag densities associated with recently burned forests, they might still fall short of the densities actually needed by these birds." p. 990.

"Existing science-based data suggest that there is little or no biological or ecological justification for salvage logging. McIver and Starr (2000) note that because of this, the justification for salvage logging has begun to shift toward arguments related to rehabilitation or restoration, but those sorts of justifications also reflect a lack of appreciation that severe fires are themselves restorative events and that rehabilitation occurs naturally as part of plant succession (Lindenmayer et al. 2004). … All things that characterize a severe disturbance event, including soil erosion and sometimes insufferably slow plant recovery, are precisely the things that constitute 'rehabilitation' for those organisms that need those aspects of disturbance events at infrequent intervals to sustain their populations."
p. 991.

II. FIRE SUPPRESSION

Fire extent in general remains heavily suppressed in western U.S. forests such that historical annual extent of burning was several times greater than the annual extent of burning under current conditions (Stephens et al. 2007). Western U.S. conifer forests remain in a serious fire deficit. Even high-intensity effects are currently deficient, relative to the extent of high-intensity fire prior to fire suppression and logging.

High-intensity fire was previously assumed to have been rare and of limited extent in most western U.S. conifer forests, largely because fire-scar studies documented frequent fire occurrence in most historicalconifer forests, and it was assumed that frequent fire would have kept surface fuel levels low, preventing high-intensity fire. The problem, however, is that fire-scar records cannot detect occurrence of past high-intensity effects, wherein most trees were killed (Baker and Ehle 2001).

Historical data and recent reconstructions of historical fire regimes indicate that high-intensity fire was common in most conifer forests of western North America prior to fire suppression and logging, even in pine-dominated forests with frequent fire regimes. For example, a recent reconstruction of historical fire occurrence in a 1,587 ha (unmanaged) research natural area near Lassen Volcanic National Park found mid-elevation slopes to be dominated by moderate-intensity fire, mixed with some low- and high-intensity effects, while upper-elevation slopes were dominated by high-intensity fire (Beaty and Taylor 2001). Other research has found steep declines in montane chaparral within mixed-conifer forest ecosystems in the Lake Tahoe Basin of the central and northern Sierra Nevada due to a decrease in high-intensity fire occurrence since the 19th century (Nagel and Taylor 2005).

In the late 19th century, John B. Leiberg and his team of United States Geological Survey researchers spent several years mapping forest conditions, including fire intensity in the central and northern Sierra Nevada. Leiberg recorded all high-intensity fire patches over 80 acres (32 ha) in size occurring in the previous 100 years (Leiberg 1902). Using modern GIS vegetation and physiographic information, Hanson (2007) compared fire locations to forest type and site conditions to examine patterns of high-intensity fire events, excluding areas that had been logged in the 19th century (which were also mapped by Leiberg) in order to eliminate the potentially confounding effect of logging slash debris (branches and twigs left behind by loggers). Hanson (2007) used areas that Leiberg had mapped as having experienced 75–100% timber volume mortality to define high-intensity fire areas.

Hanson (2007) found that high-intensity fire was not rare in historical Sierra Nevada forests, as some have assumed. Over the course of the 19th century, within Leiberg's study area, encompassing the northern Sierra Nevada, approximately one-fourth to one-third of middle and upper elevation forests burned at high-intensity (75–100% mortality) (Hanson 2007). This equates to fire rotation intervals for high-intensity fire of roughly 400 to 300 years, i.e., for a fire rotation interval of 300 years, a given area would tend to burn at high intensity once every 300 years on average (the actual high-intensity rotation would have been even shorter because Leiberg only mapped high-intensity patches over 32.4 ha [80 acres] in size). Available evidence indicates that current rates of high-intensity fire are considerably lower than this overall (Hanson 2007). For example, the Final EIS for the 2004 Sierra Nevada Forest Plan Amendment indicates that, on average, there are about 15,000 acres of high-intensity fire occurring per year in Sierra Nevada forests (entire Sierra Nevada included) (USDA 2004). Given the size of the forested area in the Sierra Nevada, about 13 million acres (Franklin and Fites-Kaufman 1996), this equates to a high-intensity fire rotation interval of more than 800 years in current forests (longer rotation intervals correspond to less high-intensity fire) (Hanson 2007). The data in Table 1 of Miller et al. (2009) similarly indicate current high-intensity fire levels of less than 50,000 ha in conifer forests on Sierra Nevada national forest lands (which contain the great majority of the conifer forest in the Sierra Nevada) over 21 years. The authors stated that 40% of the fires were not included in their data set (Miller et al. 2009). If this additional 40% was included, this would bring the 21-year total of high-intensity fire in conifer forests in the Sierra Nevada management region to a little under 70,000 ha—i.e., less than 3,333 ha (or about 8,200 acres) per year, which equates to a current high-intensity fire rotation of more than 1,000 years in the montane conifer forests inhabited by the black-backed woodpecker within the Sierra Nevada management region.

Nor were pre-fire-suppression high-intensity patches all small, as has often been assumed. In fact, in unlogged areas mapped by Leiberg (1902), some patches of high-intensity effects were 20,000 to 30,000 acres in size, or larger (Leiberg 1902, Hanson 2007 [Figure 3.1]), which is greater than any current high-intensity patches.

The findings of Hanson (2007) are consistent with those of Beaty and Taylor (2001), whose reconstruction of historical fire regimes in unmanaged forests just north of the 2001 Storrie Fire area found that, despite relatively frequent low-intensity fire occurrence, moderate- and high-intensity fire were common historically in these forests. Specifically, Beaty and Taylor (2001) found that approximately 15% of montane forests 1370–1770 m in elevation burned at high intensity over a 43-year period from 1883 to 1926 (Beaty and Taylor 2001). This equates to a high-intensity rotation interval of about 300 years. Bekker and Taylor (2001) found historical high-intensity fire rotations of 200 to 250 years in eastside mixed-conifer/fir forest types north of Leiberg's study area (within the current Sierra Nevada management region). High-intensity fire rotation intervals of several hundred years in length, and much more frequent lower-intensity fire, indicates forests in which individual fires would, on average, tend to burn predominantly at low and moderate intensity, but would have the potential to burn at high intensity under certain weather and fuel-loading conditions. A high-intensity fire rotation of about 300 years was also found in the mixed-conifer and Jeffrey pine forests of the Sierra San Pedro de Martir in Baja California—forests that have never been subjected to fire suppression and have not been logged (Minnich et al. 2000).

U.S. Geological Survey data gathered more than a century ago by Leiberg (1900) provides further evidence of an active role for high-intensity fire prior to fire suppression. Leiberg (1900) gathered comprehensive data on high-intensity fire occurrence for the period 1855–1900 in the Oregon Klamath region (extending south to the California/Oregon border), presenting data on high-intensity (75–100% timber volume mortality) burned acres and acres logged for each township. Excluding the townships with any evidence of logging (in order to eliminate any confounding effects of logging), there were 12,700 acres of high-intensity fire in 72,580 acres of unmanaged forest over a 45-year period prior to fire suppression (Leiberg 1900). This equates to a high-intensity rotation of 257 years. The high-intensity rotation within the Eastern Oregon Cascades (extending south to the California/Oregon border) physiographic province (Moeur et al. 2005) prior to fire suppression and logging was 165 years overall, and was 322 years for forests with more than 85% ponderosa pine (Leiberg 1900), indicating far more high-intensity fire than is occurring currently (469-year high-intensity rotation in mature forests) (Hanson et al. 2009).

Taylor and Skinner (1998), in a reconstruction of historical fire occurrence in a 3,878-acre study area in the Klamath Mountains of California, found that 14% of the area burned at high intensity from 1850 to 1950, though they defined high-intensity very narrowly as areas in which fewer than 4 trees per acre survived the fire. Moderate-intensity effects occurred on 27% of the area, where moderate intensity was defined as only 4–8 surviving trees per acre (Taylor and Skinner 1998), which would be categorized as high-intensity in current fire intensity assessments. If all areas in which there were 8 or fewer surviving trees per acre are included in a calculation of a high-intensity rotation, the high-intensity rotation would be approximately 244 years. Their study area was just south of the Oregon/California border at elevations ranging from about 2,100 to 5,200 feet within Douglas-fir, Douglas-fir/pine, and mixed-conifer forests (Taylor and Skinner 1998). Wills and Stuart (1994) reconstructed fire history in three representative study sites in the Klamath National Forest of California, using fire-scar and tree age-class data. They found that the historical, pre-fire suppression interval between high-intensity fire events was approximately 170 to 200 years in the first study site, about 100 years in the second study site, and was intermediate between these two in the third study site. Their study area was in forests dominated by Douglas-fir, sugar pine, and tanoak at approximately 3,000 feet in elevation on slopes averaging 56% within the Salmon River Ranger District (Wills and Stuart 1994). The estimate of the current high-intensity rotation in California Klamath forests, using satellite imagery data for 1984–2005, is 1,351 years (Hanson et al. 2009, Hanson et al. 2010).

Based upon the foregoing, it is clear that there was 2–4 times more high-intensity fire historically in the range of the black-backed woodpecker in California than there is currently.

Exacerbating matters for the black-backed woodpecker, low- and moderate-intensity fire effects are heavily predominant in western conifer forests currently, and high-intensity effects comprise a minor portion of the overall area burned (Odion and Hanson 2008, Schwind 2008, Hanson et al. 2009, Hanson et al. 2010). For example, in the Pacific Northwest since 1984, high-intensity effects occurred on only about 10–12% of the area burned, and on only about 12–15% of the total area burned in California (Schwind 2008).

Contrary to popular misconception, areas that have missed the greatest number of natural fire cycles, due to fire suppression, are burning mostly at low- and moderate-intensity and are <u>not</u> burning more intensely than areas that have missed fewer fire cycles (Odion et al. 2004, Odion and Hanson 2006, Odion and Hanson 2008, Odion et al. 2010). The notion that forested areas become increasingly likely to have high-intensity effects the longer they remain unburned is simply inaccurate. Instead, as the time period since the last fire increases, forests become more mature, and develop higher forest canopy cover. This reduces the amount of sunlight reaching the forest floor and understory. In such conditions, surface fuels stay moister during the fire season, due to the cooling shade of the forest canopy, and, due to reduced sunlight, forest stands begin to self-thin small trees and lower branches of large trees. This makes it more difficult for flames to spread into the forest canopy during wildland fire. Moreover, as forests mature and canopy cover increases with increasing passage of time since the last significant fire, pyrogenic (combustible) shrub habitat declines due to decreasing sunlight availability, leading to an overall reduction in high-intensity effects (Odion et al. 2010).

Due to the combined effects of post-fire logging and fire suppression, large snag densities in all of California's forests are currently critically low, with less than 2 large snags per acre in all forested regions of the state (Christensen et al. 2008). The same severe deficit in large snags also exists in Oregon (Donnegan et al. 2008).

III. THINNING: PRE-SUPPRESSION

Post-fire salvage logging represents an important negative impact to black-backed woodpecker populations in California. However, fire suppression also actively prevents the woodpeckers' preferred habitat from being created, and fire prevention in the form of pre-fire "thinning" projects detrimentally affects the species in one of two ways. If the thinning projects meet their desired objectives, then high-intensity fire is prevented and black-backed woodpecker habitat that otherwise would have been created is also prevented. However, regardless of whether the thinning reduces fire intensity, thinning also adversely affects black-backed habitat by reducing pre-fire tree densities and canopy cover which are correlated to high post-fire occupancy rates and nest densities (Russell et al. 2007, Vierling et al. 2008).

Hutto (2008) showed that the probability of detecting a black-backed woodpecker decreased substantially with intensity of recent pre-fire timber harvesting consistent with commercial thinning (Hutto pers. comm. 2009). Even with light pre-fire forest thinning, black-backed occupancy is reduced by about 50% when the area burns relative to unthinned burned areas (Hutto 2008) (see also Fig. 8 below).

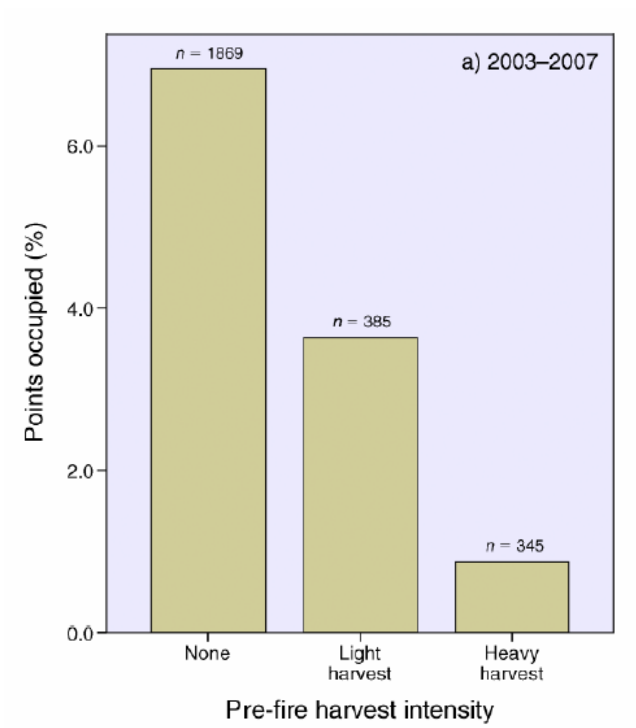

Figure 8. The probability of detecting a black-backed woodpecker decreases substantially with intensity of recent pre-fire thinning. From Hutto (2008 at p. 1,830).

Black-backed woodpeckers use burned forests that had high pre-fire canopy cover and are densely stocked with large thick-barked trees favored by wood-boring beetles (Hutto 1995, Murphy and Lehnhausen 1998, Saab and Dudley 1998, Saab et al. 2002; Nappi et al. 2003; Russell et al. 2007, Hanson and North 2008, Vierling et al. 2008). Forests that are treated to reduce the risk of high-intensity fire and to "restore" a lower-density structure are unlikely to retain characteristics needed by black-backed woodpeckers even if these stands later burn intensely. As pre-fire thinning of smaller and mature trees to reduce canopy cover, and to lower tree densities, is conducted at a greater scale (e.g., 2004 Sierra Framework, see **Impact of Existing Management Efforts**), less suitable habitat will exist for the species once fire burns through the treated stands. This will be especially true where thinning occurs in potential black-backed woodpecker habitat: CWHR 4M; 4D; 5M; 5D; and 6.

IV. PAST LOSS OF OLD FOREST DUE TO LOGGING

Historical logging in the Sierra Nevada has resulted in substantial declines in dense, old forests and removal of key components of black-backed woodpecker habitat, including large trees and snags and high canopy closure, from sizeable portions of the landscape (Leiberg 1902, McKelvey and Johnston 1992, Franklin and Fites-Kaufman 1996, Beardsley et al. 1999, Zielinski et al. 2005).

Forests of the Sierra Nevada include extensive areas of private and federal lands. Approximately 74% of the black-backed woodpecker's range in the Sierra Nevada is in public ownership and about 26% is in private ownership (USDA 2001 [Vol. 2, Chpt. 3, part 3.1, p. 65]) (foothills were excluded since they are below the elevational range of black-backeds). The majority of the private lands capable of providing mature coniferous forests, however, are industrial timberlands (PRIME California Inventory Data 1997). Logging on these industrial timberlands has been particularly intensive north of Yosemite National Park, where approximately 38% of the land (755,200 ha) is in private ownership, of which 420,400 ha is predominantly managed as industrial timberlands (PRIME California Inventory Data 1997).

Unlike the Pacific Northwest, where the majority of logging was accomplished through clearcutting, logging methods have 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 methods, however, has been largely the same—the removal of late-successional/old-growth forest conditions from large portions of the landscape. Verner et al. (1992 on pp. 10–11) 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."

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 timber 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 major 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 very large trees and a high degree of structural complexity (Sudworth 1900, Leiberg 1902, McKelvey and Johnston 1992, Franklin and Fites-Kaufmann 1996 on p. 652). 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 [late successional / old-growth]-related structural complexity occupied the majority of the commercial forestlands in the Sierra Nevada in presettlement times."

Primarily because of logging, present-day Sierran forests are drastically different from those in pre-settlement times. Franklin and Fites-Kaufmann (1996 on pp. 648–649) 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 old forests have been substantial. 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 forests in the mixed conifer, true fir, and pine types declined from 45% to 11% of the landscape between 1945 and 1993. This is a startling finding, given that the majority of the old forest had already been logged before 1945 (Leiberg 1902). Remaining old forest now occurs primarily on federal lands, reflecting the substantial degradation of private lands. The authors stated that by 1993 "[o]f the 4.8 million acres of mixed-conifer forests in the Sierra Nevada, 371 thousand acres (8%) were old-growth…Less than 2% of the 3 million acres of privately owned coniferous forests was old-growth."

Loss and degradation of old forests have been particularly severe in the central and northern Sierra Nevada, where logging began early and which contains 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 intensive 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. Beesley (1996 on p. 18), 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."

Logging impacts also have been extensive 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).

Zielinski et al. (2005) examined changes in old forest cover in the Sierra Nevada over the previous century, as part of a study on changes in the distribution of forest carnivores. 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). In 1945, old-growth (where >50% of cover was from mature trees) comprised 50% of the forested area in the Sierra Nevada, and young growth/old-growth (where 20–50% of cover was from mature trees) comprised an additional 26% of the area (the remaining 24% was young growth (immature forest), poorly-stocked forest, and non-commercial areas incapable of producing mature forest). By 1996, only 3% of the forested area in the Sierra Nevada was highest-ranking old forest, with 38% of the Sierra Nevada being low to high-quality old forest—equating to the loss of approximately half of the old forest between the 1940s and the 1990s (Figure 9). These changes were most evident in the portion of the Sierra Nevada north of Yosemite National Park, where the loss of old forest conditions has been greatest (again, these losses do not include the losses that occurred prior to the 1940s).

Overall, synthesizing all of the available lines of scientific evidence, as a result of past logging, old forest has declined from 50–90% of the landscape historically to only about 11% currently (USDA 2001 [FEIS, Vol. 2, Chpt. 3, part 3.2, pp. 141, 149]). In other words, historically there was approximately 4 to 8 times more old forest than there is today.

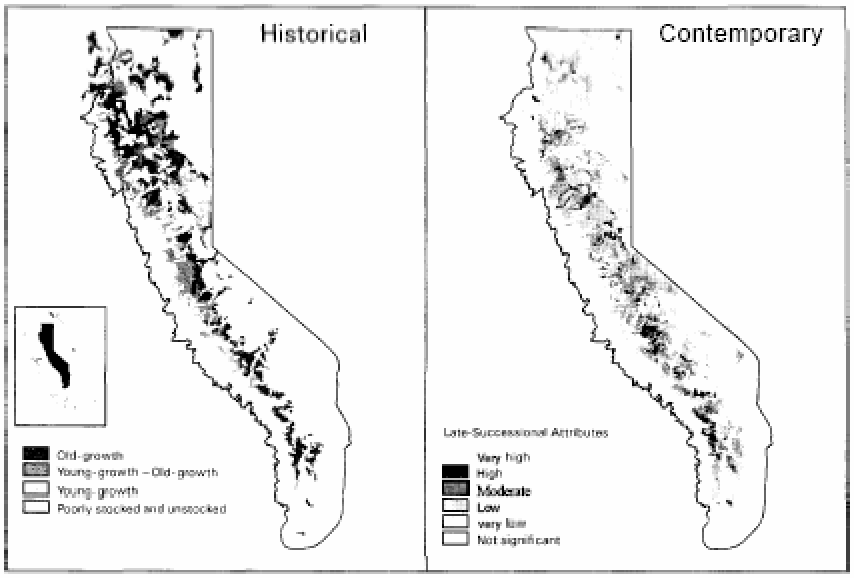

Figure 9. Maps of historical (Weislander Vegetation Type Survey, 1929 and 1934) and contemporary (Sierra Nevada Ecosystem Project, 1996) old forest cover in the Sierra Nevada. From Zielinski et al. 2005.

V. CLIMATE CHANGE

Though it is often popularly assumed that climate change will result in more fire, and more intense fire, in California's forests, the scientific evidence does not clearly support that assumption and in fact may contradict it. The warming climate more likely will lead to vegetation changes that will reduce the abundance of pyrogenic vegetation, leading to a fire "retreat" (reduced fire activity) in most of California's forests, while desert areas, and the Great Basin area just to the east of the Sierra Nevada, will see fire increases (Krawchuk et al. 2009 [Figure 3]). Moreover, summer precipitation may be a more powerful predictor of fire behavior than temperature, as the former reduces fire while the latter increases it (Parisien and Moritz 2009), and summer precipitation is projected to increase in future decades, leading to a likely overall reduction in fire in California's forests, even as temperature increases (McKenzie et al. 2004 [Figure 1]). Though, in any given one or two decades, precipitation may increase or decrease somewhat, often depending upon warm or cold phases of the Pacific Decadal Oscillation (PDO), actual data from weather stations over the past *several* decades shows an overall progressive pattern of increases in precipitation, especially summer precipitation (which reduces wildland fire occurrence and intensity) in California (WRCC 2010) and in the area just north of the California/Oregon border (Mote 2003). Similar increases in summer precipitation in Canada's boreal forests have led to a progressive decline in high-intensity fire occurrence and, consequently, a decline in black-backed woodpecker habitat over the past 150 years (Girardin et al. 2009). Further, comprehensive data from the U.S. Forest Service's research branch and the U.S. Geological Survey conclude that, since 1984, there has been no increase in fire intensity (Schwind 2008) (all vegetation types combined). Specifically in forests, Hanson et al. (2009) found that fire intensity has not increased since 1984 in the California Klamath and California Cascades regions in northern California; and Collins et al. (2009) found no increase in fire intensity in a forested study area in Yosemite National Park. Lutz et al. (2009) modeled fire intensity in Yosemite National Park, comparing 1985–2006 to 2020–2049. Their data show that the high-intensity proportion is projected to remain at about 16% in both the current and future time periods (Lutz et al. 2009 [Table 1]), despite the fact that the authors inexplicably made vague reference to increasing fire intensity in the "Discussion" section of their study.

Miller et al. (2009) reported an increase in summer precipitation in the Sierra Nevada over the past several decades, but also reported an increase in fire intensity in *some* forest types since 1984 in the Sierra Nevada, but they excluded 40% of the available fire intensity data. Also, they used current GIS layers for vegetation to exclude shrubs, which can lead to a disproportionately large exclusion of conifer forest that burned at high intensity in the earlier years of the data set, and which was more recently re-classified as shrub habitat (more recent high-intensity patches still appear as forest in remote sensing, whereas older high-intensity patches, due to snag attrition and shrub maturation, appear as shrub habitat). This leads to the appearance of an upward trend in fire intensity where none actually exists (Hanson 2010). Using complete fire data, and using pre-1984 GIS layers for vegetation (in order to avoid excluding more high-intensity fire in conifer forest in the earlier years), Hanson and Odion (in review) found no increase in fire intensity in forests of the Sierra Nevada (and no increase in high-intensity patch size), consistent with all other current research on this subject.

IMPACT OF EXISTING MANAGEMENT

I. SIERRA NEVADA FOREST PLAN AMENDMENT: NATIONAL FOREST LANDS

In the early 1990s, concerns about the conservation status of the California spotted owl (*Strix occidentalis occidentalis*) 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. In 1996, the Sierra Nevada Ecosystem Project ("SNEP Report:" Centers for Water and Wildland Resources 1996) was submitted to Congress, which 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 also 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 and old-growth forests. 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 "2001 Framework."

The 2001 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 (USDA 2001 [see Record of Decision]) designed to protect and manage old forests and associated wildlife species included:

(1) the designation of 4.25 million acres of Old Forest Emphasis Areas (OFEAs) and the promotion of old-forest conditions in OFEAs by restricting harvest of trees above 30.5 cm and prohibiting reduction of forest canopy by more than 10%;

(2) the protection of all old-forest stands 1 acre or larger by managing them as OFEAs; and

(3) the implementation of standards and guidelines prohibiting removal of medium and large trees (>51 cm) outside of OFEAs, and prohibiting reduction of canopy cover by more than 20% outside of OFEAs.

(4) the prohibition of post-fire salvage logging (removal of snags over 38.1 cm dbh) in any OFEAs except in rare circumstances in which removal of one or more large

snags was established to be necessary by the Forest Service to benefit old-forest structure and function.

The 2001 Framework provided some minimum protection for black-backed woodpeckers not only by greatly restricting post-fire logging of black-backed woodpecker habitat (old forest that experiences high-intensity fire) but also by retaining medium and large diameter trees in OFEAs and smaller old-forest stands and by maintaining canopy cover at a minimum of 50% and limiting reductions in canopy cover to 10–20%, thus protecting *potential* black-backed woodpecker habitat. However, almost immediately following the adoption of the 2001 Framework 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 Sierra Nevada Forest Plan Amendment Record of Decision was signed on January, 2004 (2004 SNFPA).

The 2004 SNFPA (see USDA 2004) eliminated the previous requirement to retain large snags (over 38.1 cm dbh) in OFEAs, eliminated the requirement to retain portions of fires unlogged (turning this into a mere option, rather than a requirement), and also eliminated or greatly weakened retention standards for structural elements such as large trees and canopy cover in all land allocations throughout the Sierra Nevada. With respect to large trees, the original Framework included a logging upper diameter limit of 30.5 cm within OFEAs and 53 cm in general forest and threat zones. The 2004 SNFPA replaced these standards with a harvest diameter limit of 76.2 cm applicable in all land allocations. Moreover, the 2004 SNFPA also allows canopy cover to be reduced by as much as 30%, to a minimum of 40%, in CWHR 5M, 5D, and 6 areas, and requires no canopy cover retention in CWHR 4M and 4D areas.

The 2004 SNFPA eliminated meaningful protection of OFEAs and smaller old-growth stands by allowing harvest of large trees up to 76.2 cm dbh and managing them similar to general forest. The weakening of habitat protections under the 2004 SNFPA significantly reduces the likelihood of black-backed woodpecker persistence in the Sierra Nevada.

Finally, the 2004 SNFPA significantly weakened protection for eastside forests in the Sierra Nevada. It eliminated any retention standards for canopy cover in eastside forests, even in CWHR 5M, 5D, and 6 areas. This egregious omission of any protection whatsoever for canopy cover in eastside forests is yet another failure of existing regulatory mechanisms to ensure the conservation the black-backed woodpeckers.

The revisions to the original 2001 Framework were ostensibly implemented to increase flexibility in fuels management, the result of which would decrease the incidence of high-intensity fire in the Sierra Nevada. Indeed, the 2004 SNFPA explicitly stated that its goal was to essentially eliminate high-intensity fire from the forested landscape (USDA 2004). The decrease in high-intensity fire, together with the removal of trees of various sizes in unburned forests from pre-fire thinning projects, would result in an additive loss of available habitat for black-backed woodpeckers in California.

The 2004 SNFPA's elimination of previous protections for old forest that experienced high-intensity fire has profound consequences for the black-backed woodpecker because it allows 100% removal of black-backed habitat 100% of the time on national forest lands outside of statutorily designated Wilderness Areas. Hanson (2007) investigated foraging ecology of black-backed woodpeckers in logged and unlogged burned forests in the Sierra Nevada. No black-backeds were found in salvage-logged stands. Moreover, Hanson documented that the species may be selecting snags at least 40 cm dbh for foraging – the very snags targeted for removal in salvage logging projects. Dr. Hanson concluded (at p. 12) that:

> "[t]he results of this study indicate that current Forest Service salvage prescriptions leaving 2–6 large (generally > 50 cm dbh) snags/acre (5–15/ha) do not provide sufficient snag densities to support significantly greater foraging for Black-backed…woodpeckers. In this study, large snag retention (18/ha) in the high severity/logged strata was higher than minimum prescriptions, due to the fact that some additional snags, generally in the 50–60 cm dbh size range, were retained because they were deemed to be unmerchantable, yet foraging time was significantly reduced for [black-backed woodpeckers.] Recent revisions to post-fire management on National Forests of the Sierra Nevada allow minimum retention levels of large snags to be achieved by averaging snags in moderate and low severity patches across the entire fire area, while removing all snags >25 cm dbh in high severity patches (USDA 2004), which would further adversely impact foraging for these species."

Because there are no requirements that ANY black-backed woodpecker habitat be retained on national forests lands under the 2004 SNFPA (outside of designated Wilderness), existing rules/laws are clearly inadequate. Moreover, as noted above, only 21% of the small amount of black-backed woodpecker suitable habitat that currently exists is within protected lands (mostly Inventoried Roadless Areas) where post-fire logging is generally not allowed (e.g., National Parks, Wilderness Areas, and Inventoried Roadless Areas). It must be noted, however, that Inventoried Roadless Areas are not specifically protected in the 2004 SNFPA forest plan, and numerous post-fire logging projects have been recently proposed, and often implemented, in Inventoried Roadless Areas on national forest lands in California, so even these areas are not reliably protected from post-fire logging, further threatening the black-backed woodpecker.

On November 4, 2009, the Federal District Court for the Eastern District of California ruled that a new Environmental Impact Statement must be prepared, since the 2004 SNFPA was ruled to be illegal under NEPA by the Ninth Circuit Court of Appeals. *Sierra Forest Legacy v. Rey*, 2009 WL 3698507 (E.D. Cal., November 4, 2009).

In early February of 2010, the Forest Service released the Draft Supplemental EIS for the new SNFPA ("2010 SNFPA") in accordance with the district court's order (USDA 2010). The 2010 SNFPA proposed action is to simply continue implementation of the 2004 SNFPA, which overtly states a goal of eliminating high-intensity wildland fire (mislabeled "catastrophic wildfire" by the U.S. Forest Service) from the forested landscape in the Sierra Nevada management region, which includes the southern Cascades up to the California/Oregon border (USDA 2004). Indeed, to promote the 2004 SNFPA, the Forest Service produced and disseminated a 2004 public outreach brochure, entitled, "Forests With A Future: A Campaign Against Catastrophic Wildfire," which made clear the agency's goal of eliminating high-intensity wildland fire from Sierra Nevada forests. Further, the 2010 SNFPA DSEIS (pp. 23–36) evaluates alternatives as being positive to the greatest extent that they promote forest management in order to: reduce snag density and snag recruitment (which the 2010 SNFPA DSEIS defines as advancing "forest health"); reduce overall annual fire extent; prevent moderate- and high-intensity fire effects on the landscape (and facilitate only low-intensity effects that do not change stand structure); and facilitate increased post-fire salvage logging (e.g., the alternatives that are described most favorably [2010 SNFPA DSEIS, p. 35] are those that allow the greatest amount of post-fire salvage logging [2010 SNFPA DSEIS, Table 2.4.5d]). Thus, on federal public lands, the 2010 SNFPA overtly seeks to **eliminate** the creation of black-backed woodpecker habitat in the first place, as well as **eliminate** any black-backed woodpecker habitat that is created by fire (the only place in which this would not be true is designated Wilderness Areas, where logging is prohibited by federal statute, though relatively little black-backed woodpecker habitat exists in Wilderness within California, as discussed above).

II. CALIFORNIA FOREST PRACTICES RULES: PRIVATE LANDS

The primary body of regulation affecting management of the black-backed woodpecker on private lands is the California Forest Practices Rules (hereafter referred to 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 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 complete removal of all black-backed woodpecker habitat and do not provide protection of elements essential to the species, 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.

Lack of forests with late-successional characteristics on private lands is not surprising given that the applicable rules allow maximization of timber production utilizing intensive logging methods. 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 (clearcutting) 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).

Specific regeneration methods recommended in the Rules include clearcutting, 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; shelterwood regeneration, in which a stand is removed in three steps; transition; and selection and group selection logging. These regeneration methods entail complete removal of forest canopy and large trees, and as is clear by their definitions, would result in elimination of black-backed woodpecker habitat. In addition, regeneration methods result in significant reductions in canopy closure. This has the potential to degrade potential black-backed habitat by reducing pre-fire canopy closure. In addition, the goal of maximum timber production and the various harvest methods are likely to result in removal of merchantable snags and trees appropriate for the future recruitment of large snags.

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 woodpecker—high densities of trees, and large trees and snags.

The Rules also 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 remove most trees, leaving a relatively small number of widely spaced trees. Such stands lack most or all of the stand components required by the black-backed woodpecker if the stands later burn at high-intensity simply because there are not enough large snags to ensure suitable black-backed woodpecker habitat.

Most troubling for black-backed woodpeckers is the fact that the laws governing forest management on private lands in California allow immediate removal of 100% of

suitable black-backed woodpecker habitat. Post-fire salvage logging, or the "emergency management" of timber, is exempted from the requirements of the THP process. This exemption applies to stands that have been substantially affected by fire or other natural causes. Cal. Pub. Res. Code § 4592; 14 C.C.R. §§ 895.1 (definitions), 1052, 1052.1, 1052.2. In addition, the sanitation/salvage method is a commonly utilized prescription under exemptions to the timber planning process 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.

While the Forest Practices Rules provide no explicit protection for the black-backed woodpecker 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 black-backeds, do not require identification of black-backed habitat, and provide no information concerning possible thresholds over which impacts to black-backed habitat or the species might be "significant." Thus, it is very unlikely that this requirement would result in significant additional protection for woodpecker habitat. Further, the Rules fail to identify what constitutes a significant impact, and reduction of impacts is generally treated as optional, rather than required.

Although snags clearly are a critical component of woodpecker habitat, the Rules list numerous conditions under which snags may be removed and fail to require that a minimum number of snags be retained, meaning that black-backed woodpecker habitat can be clearcut. 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)). 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 woodpecker. In practice, few timber harvest documents appear to require retention of snags.

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 black-backed woodpecker populations on private land. The "emergency management" of burned forests is exempted from THP requirements. The result is that essentially all intensely burned forests on private lands is immediately salvage-logged with no protections or even surveys for the black-backed woodpecker. The net result is that the Rules do not regulate logging on private lands in a manner that is adequate to maintain black-backed woodpecker habitat or populations on private land within California.

III. POST-FIRE SALVAGE (PUBLIC AND PRIVATE LANDS) LOGGING OVER THE PAST SEVEN YEARS

Petitioners have gathered information on post-fire salvage logging (both public and private lands) and commercial thinning operations (public lands) over the past 7 years (the time frame for which burned forests are suitable for *P. arcticus*) in the Sierra Nevada, which comprises essentially all of the black-backed woodpecker's range in California. Herein, we present this information as evidence that post-fire salvage logging primarily, and commercial thinning secondarily, is systematically eliminating critical habitat for the species. We express the area involved in acres, rather than in hectares, in this section because the documents cited used acres instead of hectares.

Post-fire Salvage Logging on Private Lands—The vast majority of the black-backed woodpecker habitat created on private lands since 2003 occurred within the Moonlight and Wheeler fire area, and much lesser, but significant, amounts occurred on private lands in the Freds and Power fire areas. These examples, discussed below, describe the great majority of the effects of post-fire salvage logging to black-backed woodpecker habitat on private lands in California since 2003.

Moonlight & Wheeler Fire Area: A total of 19,238 acres of private land are within the Moonlight/Wheeler fire area (USDA 2009a [Moonlight and Wheeler RFEIS, p. 1]). Using the methods described above in the assessment of existing black-backed woodpecker habitat, we determined that there were 8,237 acres of high-intensity fire in mature forest with moderate/high pre-fire canopy cover (CWHR 4M, 4D, 5M, 5D, and 6) created on private lands by the adjacent Moonlight and Wheeler fires of 2007. There were also 3,962 acres of moderate-intensity fire in mature forest with moderate/high pre-fire canopy cover created on private lands by the Moonlight/Wheeler fire. Thus, a combined total of 12,199 acres of suitable and marginal black-backed woodpecker habitat resulted on private lands from the Moonlight/Wheeler fire in 2007. As of the summer of 2008 (approximately one year post-fire), 11,454 acres had been salvage logged on private lands within the Moonlight/Wheeler fire area after the occurrence of the Moonlight and Wheeler fires (USDA 2009a [Moonlight and Wheeler RFEIS, Table B-2]). Salvage logging was ongoing at this time, and additional post-fire salvage logging on private lands within the Moonlight/Wheeler fire area occurred after the Moonlight and Wheeler RFEIS was issued. There were 2,817 acres of low-intensity fire on private lands in mature forest with moderate/high pre-fire canopy cover within the Moonlight/Wheeler fire area. Little if any salvage logging occurred in these low-intensity areas since there were very few fire-killed trees. There were also some non-forested and very sparsely forested or immature forest areas on private lands where little if any salvage logging would have occurred (due to lack of any significant merchantable timber volume). Therefore, it is clear that, by one year post-fire (at which point in time 11,454 acres of post-fire salvage logging already had occurred on private lands in the Moonlight/Wheeler fire area), most (and likely the great majority) of the 12,199 acres of suitable and marginal black-backed woodpecker habitat already had been salvage logged on private lands within the Moonlight/Wheeler fire area.

Freds Fire Area: A total of 3,110 acres of private land are within the Freds fire area (USDA 2005b [Freds FEIS, p. 3]). Using the methods described above in the assessment of existing black-backed woodpecker habitat, we determined that there were 281 acres of high-intensity fire in mature forest with moderate/high pre-fire canopy cover (CWHR 4M, 4D, 5M, 5D, and 6) created on private lands by the Freds fire of 2004. There were also 195 acres of moderate-intensity fire in mature forest with moderate/high pre-fire canopy cover created on private lands by the Freds fire. Thus, a combined total of 476 acres of suitable and marginal black-backed woodpecker habitat resulted on private lands from the Freds fire in 2004. As of the summer of 2005 (approximately one year post-fire), 2,100 acres had been salvage logged (clearcut) on private lands within the Freds fire area after the occurrence of the Freds fire (USDA 2005b [Freds FEIS, p. 417]). Salvage logging was ongoing at this time, and additional post-fire salvage logging on private lands within the Freds fire area occurred after the Freds FEIS was issued. There were 127 acres of low-intensity fire on private lands in mature forest with moderate/high pre-fire canopy cover within the Freds fire area. Little if any salvage logging occurred in these low-intensity areas since there were very few fire-killed trees. There were also some non-forested and very sparsely forested or immature forest areas on private lands where little if any salvage logging would have occurred (due to lack of any significant merchantable timber volume). Therefore, it is clear that, by one year post-fire (at which point in time 2,100 acres of post-fire salvage logging had already occurred on private lands in the Freds fire area), most (and perhaps all) of the 476 acres of suitable and marginal black-backed woodpecker habitat had already been salvage logged on private lands within the Freds fire area.

<u>*Power Fire Area*</u>: A total of 3,382 acres of private land are within the Power fire area (USDA 2005a [Power FEIS, Summary, p. i]). Using the methods described above in the assessment of existing black-backed woodpecker habitat, we determined that there were 675 acres of high-intensity fire in mature forest with moderate/high pre-fire canopy cover (CWHR 4M, 4D, 5M, 5D, and 6) created on private lands by the Power fire of 2004. There were also 570 acres of moderate-intensity fire in mature forest with moderate/high pre-fire canopy cover created on private lands by the Power fire. Thus, a combined total of 1,245 acres of suitable and marginal black-backed woodpecker habitat resulted on private lands from the Power fire in 2004. As of the summer of 2005 (approximately one year post-fire), 938 acres had been salvage logged on private lands within the Power fire area after the occurrence of the Power fire (USDA 2005a [Power FEIS, p. 360]). Salvage logging was ongoing at this time, and additional post-fire salvage logging on private lands within the Power fire area occurred after the Power FEIS was issued. There were 678 acres of low-intensity fire on private lands in mature forest with moderate/high pre-fire canopy cover within the Power fire area. Little if any salvage logging occurred in these low-intensity areas since there were very few fire-killed trees. There were also some non-forested and very sparsely forested or immature forest areas on private lands where little if any salvage logging would have occurred (due to lack of any significant merchantable timber volume). Therefore, it is clear that, by one year post-fire (at which point in time 938 acres of post-fire salvage logging had already occurred on private lands in the Power fire area), the majority of the 1,245 acres of suitable and marginal black-backed woodpecker habitat had already been salvage logged, or was being salvage logged, on private lands within the Power fire area.

Post-fire Salvage Logging on Public Lands—Most (75%) of the black-backed woodpecker habitat created since 2003 occurred within four fire areas: the Moonlight and Wheeler fire area; the Freds fire area; the Power fire area; and the American River

Complex fire area. As described above, most of all current suitable black-backed woodpecker habitat in California was created in 2007 in a single fire area: the Moonlight/Wheeler fire area. These examples, discussed below, describe the great majority of the effects of post-fire salvage logging to black-backed woodpecker habitat on public lands in California since 2003.

Moonlight and Wheeler Fire Area: By the Plumas National Forests' definition of suitable black-backed woodpecker habitat (moderate and high burn intensity [>50% basal area mortality] in mature forest with moderate and high pre-fire canopy cover [CWHR 4M, 4D, 5M, 5D, and 6]), the Moonlight and Wheeler Fires "Recovery and Restoration" Project (Moonlight and Wheeler Project) would salvage log about 38% of the suitable black-backed woodpecker habitat on public lands within the Moonlight/Wheeler fire area—12,397 acres salvage logged out of a total of 32,569 acres of suitable black-backed woodpecker habitat (as defined by the Plumas National Forest) on public lands in the Moonlight/Wheeler fire area (USDA 2009a [Moonlight and Wheeler RFEIS, p. D-36, Table 1]). The salvage logging of those 12,397 acres of black-backed woodpecker habitat began in the summer of 2009 and is ongoing currently. An additional 7,525 acres of burned forest habitat (11% of the 68,409 acres of public lands within the "analysis area" [i.e., the combined Moonlight and Wheeler fire areas]) were salvage logged on public lands within the Moonlight/Wheeler fire area prior to implementation of the Moonlight and Wheeler Project via roadside "hazard tree" logging projects (USDA 2009a [Moonlight and Wheeler RFEIS, p. 71]). The Moonlight and Wheeler RFEIS does not divulge how much of this 7,525 acres of roadside logging was within suitable black-backed woodpecker habitat but, given that the Plumas National Forest broadly defined nearly half of the public land acreage in the Moonlight/Wheeler fire area as suitable black-backed woodpecker habitat (USDA 2009a [Moonlight and Wheeler RFEIS, p. D-36, Table 1]), we can estimate that, of the 7,525 acres of roadside salvage logging, roughly 3,500 acres of black-backed woodpecker habitat was eliminated. Approximately 500 acres of additional post-fire salvage logging on public lands occurred within the Moonlight/Wheeler fire area through the Camp 14 and North Moonlight logging projects (USDA 2009a [Moonlight and Wheeler RFEIS, p. 71]). Therefore, of the 32,569 acres characterized by the Plumas National Forest as suitable black-backed woodpecker habitat on public lands within the Moonlight/Wheeler fire area, approximately 20,000 acres (about 61%) have been salvage logged, or are in the process of being salvage logged, on public lands.

Moreover, as evidenced by a 2008 Forest Service map of planned salvage logging in the Moonlight/Wheeler fire area, essentially all of the remaining black-backed woodpecker habitat was initially planned for post-fire salvage logging—much of it via the "Frazier Fire Recovery and Restoration Project" (Frazier Project), which would have salvage logged 18,074 acres (see **Appendix D** attached hereto). The Frazier Project proposal was not advanced beyond the initial planning stage after Earth Island Institute successfully filed suit against the largest of the roadside salvage logging projects, alleging that the Forest Service failed to analyze direct and cumulative environmental impacts in an EIS (*Earth Island Institute v. Carlton*, Case No. 2:08-cv-01957-FCD-EFB). Therefore, it was only because a nonprofit conservation organization happened to be able to file suit, and was successful, that the entirety of the black-backed woodpecker habitat was not salvage logged on public lands in the Moonlight/Wheeler fire area—the fire area that contains most of the little existing suitable habitat for this species in the entire state of California (as discussed above). Of course, nonprofit conservation groups are not always able to file or sustain costly and time-consuming lawsuits against the federal government, and even successful lawsuits often represent empty victories as most of the planned logging will have already occurred by the time the case is resolved. Moreover, now that post-fire logging is being done primarily for biomass in some projects (rather than sawtimber), the mere fact that several years may have passed since the fire in question, and the fact that the trees are no longer merchantable for lumber, does not mean that the area in question will not be subjected to post-fire logging—even clearcutting (or close to it)—for biomass production, as the Lake Tahoe Basin Management Unit (LTBMU) just decided to do in the Angora fire area. The Environmental Assessment for that logging project admits that it would "remove" 70% of all suitable black-backed woodpecker habitat on the Angora fire, which equates to nearly all remaining suitable habitat on the entire LTBMU national forest currently, for biomass production (see LTBMU website for the Environmental Assessment and Decision Notice for the "Angora Fire Restoration Project"). This is a very dangerous precedent that greatly compounds the already very serious risks and threats to the viability of the black-backed woodpecker population in California. Because the Framework forest plan does not require ANY protections for black-backed woodpecker habitat, the remaining black-backed woodpecker habitat in the Moonlight-Wheeler fire area—i.e., after the current salvage logging for sawtimber is completed—would still be under threat from a future biomass logging project.

Freds Fire Area: On public lands within the Freds fire area, the Forest Service estimated that there were approximately 3,025 acres of forest with moderate-intensity and high-intensity effects prior to post-fire salvage logging (USDA 2005b [Freds FEIS, p. 276]). Under the chosen alternative, Alternative 1, all of this was proposed for post-fire salvage logging on public lands, except three small "snag retention clumps" of 55 acres, 62 acres, and 47 acres, respectively (USDA 2005b [Freds FEIS, p. 278, Table 3-78]). In other words, approximately 95% of the black-backed woodpecker habitat was proposed for logging. The Ninth Circuit Court of Appeals ruled that this logging was illegal, but every acre of the planned salvage logging was cut by the time this ruling was issued, given that the district court denied plaintiff's request for a preliminary injunction (which is almost always the case with challenges to post-fire salvage logging within black-backed woodpecker habitat in California). *Earth Island Institute v. U.S. Forest Service*, 442 F.3d 1147 (9th Cir. 2006).

Power Fire Area: On public lands within the Power fire area, the Forest Service proposed to salvage log 4,991 acres of the 6,282 acres of black-backed woodpecker habitat on public lands within the Power fire area under the chosen alternative, Alternative 4 (USDA 2005a [Power FEIS, p. 249, Table 3-77])—an elimination of nearly 80% of black-backed woodpecker habitat on public lands in the Power fire area. The Ninth Circuit Court of Appeals ruled that this logging was illegal, but most of the planned salvage logging was cut by the time this ruling was issued, given that the district court denied plaintiff's request for a preliminary injunction (which is almost always the case with challenges to post-fire salvage logging within black-backed woodpecker habitat in California). *Earth Island Institute v. U.S. Forest Service*, 442 F.3d 1147 (9th Cir. 2006).

<u>American River Complex Fire Area</u>: On public lands within the American River Complex Fire Area, out of a total of 2,189 acres of suitable black-backed woodpecker habitat in this fire area, the Forest Service proposed to salvage log 849 acres of suitable black-backed woodpecker habitat, plus an additional 164 acres of suitable black-backed woodpecker habitat that would be salvage logged within the boundaries of a pre-fire timber sale that had not been completed at the time of the fire (USDA 2009c [Black Fork MIS Report, p. 14]). Therefore, a total of 1,013 acres out of 2,189 acres (46%) of suitable black-backed woodpecker habitat was proposed for salvage logging. This salvage logging is currently ongoing. The black-backed woodpecker habitat that was not proposed for salvage logging existed largely within the North Fork American Inventoried Roadless Area. Salvage logging usually does not occur in Roadless Areas due to the Roadless Rule, though, as discussed above, there is no blanket prohibition against post-fire logging in Roadless Areas under the Rule, and the U.S. Forest Service has often proposed, and occasionally implemented, intensive post-fire logging in Roadless Areas in California. Specifically, 53% of the moderate-intensity and high-intensity burn areas within this fire occurred within the Roadless Area (USDA 2009b [Black Fork EA, p. 2, Table 1.1]). In the project analysis documents for this post-fire salvage logging project, the Tahoe National Forest defined suitable black-backed woodpecker habitat as 75–100% basal area mortality in mature forest with moderate/high pre-fire canopy cover, i.e., 75–100% mortality in CWHR 4M, 4D, 5M, 5D, and 6 montane conifer forests (USDA 2009b [Black Fork EA, p. 75]).

SUGGESTIONS FOR FUTURE MANAGEMENT

A. Establish black-backed woodpecker protection zones at least 150 ha in size (i.e., home range size) to include all areas of moderate- to high-intensity burned mature and old-growth conifer forest with moderate to high pre-fire canopy cover (i.e., potential nest stands). No salvage logging would be allowed within these potential nest stands or home ranges.

B. Retain all trees with black-backed woodpecker nest cavities.

C. In unburned forests, retain patches of snags in a variety of decay stages, including those susceptible to future insect occupancy. Prevent salvage logging in large patches of high conifer mortality from beetles/competition/drought.

D. Halt or greatly restrict and reduce fire suppression activities outside of the urban/wildland interface, at least until average annual fire extent approximates historical, pre-suppression extent.

E. Focus fuel-reduction thinning operations in the immediate vicinity of homes or administrative structures (www.firelab.org), and halt current plans to reduce/eliminate high-intensity fire in conifer forest wildlands not adjacent to homes.

F. Prohibit insecticide use in forest habitats within the range of the black-backed woodpecker.

CONCLUSIONS

Black-backed woodpeckers depend upon an environment that is unpredictable and ephemeral, which remains suitable for only several years post-fire. Thus, their populations are precarious—numbers are extremely low in forests without high tree mortality from recent natural disturbance (mostly fire). Populations of black-backed woodpeckers are clearly regulated by the extent of fires and insect outbreaks and by the management actions people choose to take in those affected forests—such as salvage logging.

Unfortunately, the U.S. Forest Service and California Department of Forestry and Fire Protection provide absolutely no regulatory protection for intensely burned forests on private and public lands in California. Intensely burned forest habitat not only has no legal protection, but standard practice on private and public lands is to actively eliminate it. When fire and insect outbreaks create excellent woodpecker habitat, salvage logging promptly destroys it. Fire suppression—also standard practice—prevents the creation of new black-backed woodpecker habitat, and mechanical thinning degrades potential black-backed woodpecker habitat once a thinned area has burned. It is no surprise, then, that the woodpecker, which was once described as numerous in California, is now considered a rare species.

The John Muir Project and Center for Biological Diversity have concluded that the black-backed woodpecker is now threatened with extinction in California. Based on woodpecker density estimates using the best available scientific data, we approximate an extant population of only 161 to 300 pairs of black-backed woodpeckers in California—and the great majority of the habitat in which even those small number of pairs currently reside is threatened by current or future post-fire logging not only for sawtimber but also now for biomass production. We submit this petition to obtain desperately needed legal protection for black-backed woodpeckers and the burned forest habitat upon which they depend.

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INDIVIDUALS SUPPORTING PETITIONED ACTION

This petition is submitted on behalf of the John Muir Project of the Earth Island Institute and the Center for Biological Diversity. It is supported by the staff of the petitioning organizations, and the thousands of members of the petitioning organizations who reside in California and support the conservation missions of the organizations.

APPENDIX A. National forest, name, age, size, and dominant pre-fire habitat of 17 fires surveyed in the Sierra Nevada in 2008, number of stations at which playback surveys were conducted, and number black-backed woodpeckers detected at each station. From Siegel et al. (2008 at p. 24).

National Forest	Fire Name	Year of Fire	Years Since Fire	Hectares of Burned Area (Any Severity) on National Forest Land	Dominant Pre-fire Habitat 1	No. Stations Surveyed	No. Stations w/ BBWO Detections
Eldorado	Plum	2002	6	461	Sierra Mixed Conifer	19	0
Eldorado	Saint Pauli	2002	6	132	Sierra Mixed Conifer	0	0
Eldorado	Ralston	2006	2	2,699	Sierra Mixed Conifer	4	0
Inyo	Crater	2001	7	996	Jeffrey Pine	29	8
Lassen	Cone	2002	6	769	Eastside Pine	20	0
Lassen	Poe	2001	7	551	Sierra Mixed Conifer	0	0
Lassen	Straylor	2004	4	1,231	Eastside Pine	21	1
Modoc	Bell	2001	7	1,092	Eastside Pine	22	0
Plumas	Boulder Complex	2006	2	1,416	Jeffrey Pine	22	11
Plumas	Moonlight	2007	1	26,159	Jeffrey Pine/Red Fir	24	16
Sequoia	Cooney	2003	5	751	Jeffrey Pine/Red Fir	25	0
Sequoia	Vista	2007	1	170	Jeffrey Pine/Red Fir	20	5
Sierra	North Fork	2001	7	1,636	Sierra Mixed Conifer	20	0
Sierra	Rock Creek 2	2002	6	99	Sierra Mixed Conifer	15	0
Stanislaus	Kibbie	2003	5	1,374	Jeffrey Pine/Red Fir	39	5
Stanislaus	Mud	2003	5	1,641	Jeffrey Pine/Red Fir	33	6
Tahoe	Bassetts	2006	2	925	Subalpine Conifer	14	11
Tahoe	Gap	2001	7	947	Sierra Mixed Conifer	25	1
Tahoe	Rock Creek	2001	7	187	Jeffrey Pine/Red Fir	19	4