EFFECTS OF A WILDFIRE ON BREEDING AND WINTERING BIRDS IN THE LINCOLN NATIONAL FOREST, NEW MEXICO



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EXECUTIVE SUMMARY

In May 2000, the Scott Able fire burned approximately 16,000 acres of coniferous forest in the Lincoln National Forest in south-central New Mexico. In 2001, Hawks Aloft Inc. began a multi-year study examining the effects of the fire on breeding and wintering birds. We conducted 92 summer and winter point count surveys at six sites in burned and unburned coniferous forest.

We observed different detection rates between burned and unburned points within individual foraging and nesting guilds. Summer detection rates for ground-foraging species, hawking or hovering species, and cavity nesters were all considerably higher at burned points than at unburned points. Summer detection rates for foliage gleaners and non-cavity nesters were both considerably higher at unburned points than at burned points. Patterns were similar during the winter, except that detection rates for barkforaging and cavity-nesting species were higher in unburned habitat. Our results demonstrate how some avian groups probably responded positively to successional habitat created by fire, while some avian groups probably responded negatively.

Most species were documented using burned habitat, and some species were found almost exclusively in burned habitat. House Wrens (*Troglodytes aedon*), Violetgreen Swallows (*Tachycineta thalassina*), Western Bluebirds (*Sialia mexicana*), and Green-tailed Towhees (*Pipilo chlorurus*) were among the most commonly recorded species in burned habitat. Some species, such as Three-toed Woodpeckers (*Picoides tridactylus*), were associated with the numerous snags at our sites, perhaps benefiting from an increased availability of insects or nesting cavities. Our observations support the importance of snags, and post-fire management should consider the effects of snag removal on birds. Future studies should focus on how avian groups use snags of different sizes and densities, as well as revisiting point count sites periodically to document changes that occur over extended time periods. Because many species use, and even depend on, burned habitat, managers should consider wildfires, like the Scott Able fire, to be of some benefit to the avian community.

INTRODUCTION

Wildfires can have dramatic effects on humans and wildlife. Wildfires threaten homes, consume valuable timber, and alter the aesthetic value of parks and recreation areas. Effects of wildfire on wildlife include direct mortality and loss of habitat and food resources (Bond et al. 2002). These negative impacts have encouraged the suppression of wildfires in the last half century (Horton and Mannan 1988). Many managers systematically prescribe low-intensity fires in forested habitat to reduce understory fuel loads, thereby reducing the future risk of more intense, stand-replacing crown fires. However, eliminating stand-replacing fires completely might forfeit potential benefits to wildlife, including birds.

Wildfires can increase the diversity of birds and the population size for some species (Johnson and Wauer 1996). Hutto (1995) demonstrated how numerous species immediately benefit from, and even require, stand-replacing fires in the Rocky Mountains. Assuming a portion of forest remains unaffected by a fire, the addition of new species adapted to early successional habitat increases overall diversity. The availability of snags after a fire benefits foraging birds by increasing the availability of wood-boring and bark beetles (Imbeau and Desrochers 2002, Nappi et al. 2003). Snags also provide nesting habitat for cavity-nesting birds (Haggard and Gaines 2001, Saab et al. 2004). The foraging and nesting benefits associated with snags should diminish as food resources decrease and snags fall (Finch et al. 1997). To evaluate the effects of a wildfire on avian communities, it is important to know which species respond positively or negatively to the habitat created by the fire, as well as to understand how this response changes over time (Finch et al. 1997).

In May 2000, the Scott Able fire burned approximately 16,000 acres of mixed conifer forest in the Lincoln National Forest in south-central New Mexico. Within the fire boundary were patches of unburned forest. In 2001, we began a multi-year study for the USDA Forest Service conducting avian point count surveys at burned and unburned points along six routes. Because we began monitoring after the fire, we are unable to directly evaluate the effects of the fire on birds, based on differences between pre- and post-fire data. In this report, we use data collected from 2001 through 2005 to evaluate the seasonal abundance of birds and bird communities, relative to burned and unburned habitat. We also document the use of burned habitat by individual species. Our results are intended to identify the species or guilds most likely to have been positively or negatively affected by the Scott Able fire, as well as identify features of the burned area that affect colonization.

STUDY AREA

We conducted point count surveys along six walking or driving transects in the Lincoln National Forest in Otero County, New Mexico: Little Lewis, Pendleton, Potato-Pepper, Seep, Wayland, and Woods (Fig. 1, Appendix 1). All sites were mostly within the boundaries of the Scott Able fire, but individual survey points were not all associated with burned habitat. The area within the fire boundary consisted of a mosaic of either severely burned or mostly unburned patches. Dominant tree species in unburned habitat included Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), southwestern white pine (*Pinus strobiformis*), quaking aspen (*Populus tremuloides*), and ponderosa pine (*Pinus ponderosa*). Burned areas contained numerous snags and successional

understory plants, including gambel oak (*Quercus gambelii*), New Mexico locust (*Robinia neomexicana*), and elders (*Sambucus* spp.). Although survey points were usually along established roads or trails, much of the surveyed habitat was situated on adjacent hillsides of considerable slope.

According to the Western Regional Climate Center (http://www.wrcc.dri.edu), winter precipitation was highest during the winter of 2004-2005 (2.6 inches per month during the survey period) and lowest during the winter of 2003-2004 (1.1 inches per month). Summer precipitation was highest during 2005 (1.4 inches per month) and lowest during 2002 (0.5 inches per month).

Little Lewis (elevation 2165-2320 m) was a 16-point walking survey covering approximately 4 km of canyon along an old forest road (T239A), no longer accessible to motorized vehicles, south of the village of Weed (Fig. 1). Most points (N=10) at Little Lewis contained both burned and unburned habitat. The remaining points were either in burned (N=3) or unburned (N=3) habitat. The road separated a large burned area on one side of the canyon from mostly unburned forest on the other. Unburned forest at Little Lewis contained relatively many pines with sparse understory.

Pendleton (elevation 2390-2500 m) was a 12-point driving survey along a primitive forest road (9622C) west of the Little Lewis site (Fig. 1). A fire burned this site approximately 30 years ago, resulting in taller and thicker scrub vegetation with fewer snags than the other sites. The Scott Able fire severely burned habitat at the end of the transect, leaving numerous snags in this section.

Potato-Pepper (elevation 2350-2620 m) was a 16-point driving survey along a forest service road (437), several kilometers west of the village of Sacramento and west

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off Agua Chiquita Road (Fig. 1). Potato-Pepper contained survey points in burned (N=7) or unburned (N=3) habitat, as well as points (N=6) associated with both. The last five points were along a steep portion of the road in completely burned habitat. During some winter surveys, we walked to these points because of excessive snow cover, which prevented safe driving access.

Seep (elevation 2195-2500 m) was a 16-point driving survey along a maintained canyon road (382), south of Weed and just north of the Little Lewis site (Fig. 1). The first half of the transect consisted of points in burned habitat (N=5) or points associated with both burned and unburned habitat (N=4). The higher elevation points along the second half of the transect were in unburned habitat (N=7).

Wayland (elevation 2375-2560 m) was a 16-point walking survey along an unmarked forest road in the canyon just south of the Potato-Pepper site (Fig. 1). This canyon was wider than the other canyon sites, and canopy cover on at least one side of the transect was often 20-30 m away from survey points. Wayland contained coniferous forest similar to other sites, but it also contained several patches of oaks and aspens along an intermittent stream on the canyon floor. Most of the points at this site (N=14) were associated with both burned and unburned habitat (N=14).

Woods (elevation 2700-2835 m) was a 16-point walking survey traversing several mountain ridges near the junction of Agua Chiquita and Scott Able Canyon Roads (Fig. 1). This was the only transect not following a road or path. Most points were in either severely burned (N=6) or in completely unburned (N=8) habitat. Unlike other sites, the burned habitat at Woods was at a relatively high elevation and contained considerable New Mexico locust, with little oak or elder.



Understory in burned habitat at Woods contained mostly New Mexico locust.

METHODS

Bird Surveys

We collected four seasons of winter data and four seasons of summer data from 2001 to 2005. We conducted three surveys per site (18 total) during each winter and summer, with the exception of the first winter (2001-2002), during which we completed only one survey per site. During the remaining winters, we conducted one survey each in November, December, and January. Each summer, we conducted one survey in May and two surveys in June. Consecutive surveys at a site were separated by at least 14 days. We also conducted fall migration surveys in 2001 and 2002 at the same sites. After consulting with the Forest Service, we discontinued fall sampling and added surveys to our winter schedule, thereby matching our summer effort. We base our analysis on data

from the three winters and four summers for which we have a consistent effort of three annual surveys per site.

We used point count methodology to survey birds (see Ralph et al. 1995). We established 92 survey points (12 at Pendleton and 16 at each of the other five sites), approximately 250 m apart for walking surveys and approximately 400 m apart for driving surveys. One observer visited each point at a site, beginning within a half-hour after sunrise and concluding within four hours of sunrise. We reversed the monitoring order of points at a site for one of the three surveys per season. The observer identified and recorded all birds seen or heard for five minutes within 100 m of each point. We recorded flyovers and birds observed beyond 100 m separately on the data form. We considered using a laser rangefinder to more precisely determine distances of birds; however, because of difficulty using it in a forested environment, we opted to estimate the 100-m distance based on experience and practice exercises. Many points contained at least a small amount of both burned and unburned habitat; starting in summer 2004, we noted each bird that was found in burned habitat, to more clearly document use of burned habitat by each species.

Data Analysis

We classified survey points as burned, unburned, or mixed, according to the amount of burned habitat associated with the point (Appendix 1). We defined burned points as those with >90% of the habitat severely burned within a 100-m radius. We considered severely burned habitat to have no live trees remaining immediately after the fire. We defined unburned points as those with >90% of the habitat completely unburned



Many survey points were associated with a mix of burned and unburned habitat.

within a 100-m radius. We defined all other points, with both burned and unburned habitat, as mixed. We classified 23 of 92 points (25%) as burned, 26 points (28%) as unburned, and 43 points (47%) as mixed.

We analyzed summer and winter data separately and used detection rates as a measure of avian abundance. We first calculated a detection rate for each point (i.e., point detection rate) by adding the number of birds observed at the point during a given year and dividing by the number of surveys at the point (i.e., three). We only included birds observed within 100 m of each point. We used the point detection rates to determine an average detection rate for each year, site, or burn category. For example, the average detection rate for summer 2005 is the sum of all point detection rates for

2005 divided by the number of points (i.e., 92). We compared average detection rates among sites and among years, as well as between points classified as burned and unburned. We report all detection rates with 95% confidence intervals.

We categorized species into foraging and nesting guilds, based on classifications from Ehrlich et al. (1988). We divided species into four main foraging guilds: barkforaging, hawking or hovering, ground, and foliage-gleaning species (Appendix 2). Some species did not fit into one of those foraging categories, and we classified them as other. We divided nesting guilds into cavity or non-cavity nesting species (Appendix 2). We compared average detection rates between burned and unburned points for the birds comprising each foraging and nesting guild.

We further categorized species according to concervation concern and management indicator status. We classified some species as "priority", based on scores assigned by New Mexico Partners in Flight (2003). Scores incorporated information on abundance, distribution, and threats. Priority species included those with a combined score >19 (Appendix 2). For example, Montezuma Quail (*Cyrtonyx montezumae*) is a priority species with a score of 26; although not an endangered species, the high priority score reflects concern over low abundance and limited distribution. We compared average detection rates between burned and unburned points for priority species as a group. We also compared average detection rates between burned and unburned points for priority species as a the management indicator species identified by the USDA Forest Service: the Pygmy Nuthatch (*Sitta pygmaea*) and the Hairy Woodpecker (*Picoides villosus*).

During two summers (2004 and 2005) and one winter (2004-2005), we documented use of burned habitat during surveys. We report use of burned habitat by

each species as a percentage of observations for those years occurring in burned habitat, regardless of the burn categories assigned to each point. This percentage represents a minimum estimate of use, because we could not always discern the precise location of individuals relative to burned and unburned habitat.

We describe observations of rare or vagrant species, based partially on a list provided by the Forest Service. We list all species observed at each site in Appendix 3 (summer) and 4 (winter). We assembled photographs of each site taken in summer 2005 on a disk attached to the back of this report.

RESULTS

Summer

We observed 83 species of birds during summer point count surveys in the Lincoln National Forest from 2002 through 2005 (Appendix 3). House Wrens (*Troglodytes aedon*, 12% of summer observations) and Dark-eyed Juncos (*Junco hyemalis*, 12% of summer observations) were the most common species recorded. We recorded Red Crossbills (*Loxia curvirostra*, N=16) during the summer for the first time in 2005.

Average detection rates were similar among the six sites, except for a relatively low rate at Little Lewis (Fig. 2). Little Lewis contained an extensive line of unburned Ponderosa Pine forest with minimal understory. Although some forest species, such as Grace's Warbler (*Dendroica graciae*) and Brown Creeper (*Certhia americana*), were common at Little Lewis, many shrub species were relatively uncommon. The detection rate at Wayland was augmented by high detectability of Dark-eyed Juncos and American Robins (*Turdus migratorius*) feeding on the ground in a stretch of open habitat bordering the survey route. Similarly, Green-tailed Towhees (*Pipilo chlorurus*) and Yellow-rumped Warblers (*Dendroica coronata*) contributed to the relatively high detection rates at Pendleton and Woods, respectively. Species richness was highest at Pendleton (N=60 species), despite fewer survey points, and lowest at Woods (N=44 species, Appendix 3).

We observed a slightly higher average detection rate at burned points (9.63 \pm 0.86) than at unburned points (8.29 \pm 0.86), and differences were apparent within most foraging and nesting guilds (Fig. 3). We observed a considerably higher detection rate for foliage gleaners at unburned points (2.43 \pm 0.26) than at burned points (0.65 \pm 0.15). We observed a higher detection rate for ground species at burned points (4.49 \pm 0.36) than at unburned points (3.01 \pm 0.31). We also observed a higher detection rate for hawking or hovering species at burned points (2.80 \pm 0.67) than at unburned points (1.56 \pm 0.21). Cavity nesters had a higher detection rate at burned points (5.29 \pm 0.75) than at unburned points (2.20 \pm 0.21), whereas non-cavity nesters had a higher detection rate at unburned points (5.82 \pm 0.37) than at burned points (3.71 \pm 0.38).

We also observed differences for priority and management indicator species among burn categories. We observed a higher detection rate for priority species at burned points (1.49 ± 0.55) than at unburned (0.84 ± 0.15) points, although there is slight overlap in confidence intervals (Fig. 3). Numerous Violet-green Swallows (*Tachycineta thalassina*) using snags contributed to the relatively high detection rate for priority species at burned points. Hairy Woodpeckers, in the summer, were considerably more common at burned points (0.54 ± 0.10) than at unburned points (0.25 ± 0.05) . Pygmy Nuthatches were not numerous in the summer; we recorded them at both burned (0.05 \pm 0.07) and unburned (0.09 \pm 0.06) points.

The average detection rate in 2005 (9.49 ± 0.52) was slightly higher than the detection rate in 2004 (8.65 ± 0.51) , but similar to the previous high in 2002 (9.36 ± 0.67) , indicating little overall change in overall abundance during the four years. The detection rate at unburned points increased considerably in 2005, whereas the detection rate at burned points showed little change (Fig. 4). The increase at unburned points in 2005 appeared to be shared by most of the foraging and nesting guilds (Fig. 5).

We documented 56 species in burned habitat at least once during summer surveys in 2004 and 2005; another 15 species recorded during that time were not documented in burned habitat (Appendix 5). Violet-green Swallow (198 of 198 observations, 100%), Western Bluebird (*Sialia mexicana*, 202 of 270, 75%), Green-tailed Towhee (182 of 286, 64%), and House Wren (523 of 895, 58%) were among the most common species with at least half of observations occurring in burned habitat. Hermit Thrush (*Catharus guttatus*, 0 of 133) and Grace's Warbler (0 of 104) were among the commonly recorded species in the Lincoln National Forest absent in burned habitat in 2004 and 2005.

Several species associated with early successional habitat increased in abundance from 2002 to 2005 (Fig. 6). Detection rates steadily increased for Green-tailed Towhee, House Wren, MacGillivray's Warbler (*Oporornis tolmiei*), and Rock Wren (*Salpinctes obsoletus*). MacGillivray's Warblers were scarce at our sites when the study began; in 2005, they were fairly widespread in burned habitat containing elder at Pendleton, Potato-Pepper, and Wayland. Not observed in 2002, Rock Wrens appeared at several points in 2003. In 2004, they were widespread at Potato-Pepper; in 2005, they were widespread at both Potato-Pepper and Seep.

We observed several rare or vagrant species during summer surveys from 2002 to 2005, particularly in burned habitat. We encountered Three-toed Woodpeckers (*Picoides tridactylus*) during each year of the study, starting with eight in 2002 and ending with one each in 2004 and 2005. We observed a pair of Montezuma Quail at Seep in 2004 and another at Seep in 2005, all in burned habitat. A singing male Cassin's Finch (*Carpodacus cassinii*) was observed at Woods in 2004, and a female was observed near the same survey point in 2005. Although widespread in North America, Purple Martins (*Progne subis*) are irregularly distributed in New Mexico; we observed several flocks associated with burned habitat in the Lincoln Forest. We recorded several vagrants during summer surveys, including a pair of Hooded Warblers (*Wilsonia citrina*) and a singing male Kentucky Warbler (*Oporornis formosus*) in scrub habitat at Pendleton in 2004, as well as a female Hooded Warbler in unburned habitat in Wayland in 2005.

Winter

We observed 34 species of birds during winter point count surveys in the Lincoln National Forest from 2002 to 2005 (Appendix 4). Dark-eyed Juncos were considerably more common than any other species and accounted for 39% of all detections. We also observed numerous Mountain Chickadees (*Poecile gambeli*), Hairy Woodpeckers, and White-breasted Nuthatches (*Sitta carolinensis*). We recorded Band-tailed Pigeons (*Columba fasciata*, N=22) and Red Crossbills (N=57) during winter surveys for the first time in 2004-2005.

Winter detection rates were relatively high at Wayland and relatively low at Seep and Woods, although there is considerable overlap in confidence intervals (Fig. 7). As during the summer, we recorded the highest species richness at Pendleton (N=25 species, Appendix 4), despite fewer survey points at this site.

For most foraging and nesting guilds during the winter, we observed differences in average detection rates among burn categories (Fig. 8). As during the summer, we recorded a higher detection rate for foliage gleaners at unburned points (0.86 ± 0.21) than at burned points (0.29 ± 0.16), and a higher detection rate for ground species at burned points (2.07 ± 0.66) than at unburned points (1.27 ± 0.26). Unlike summer season results, we recorded a higher detection rate for bark-foraging birds at unburned points (1.04 ± 0.27) than at burned points (0.69 ± 0.03). Large numbers of all three nuthatches in unburned habitat in 2004-2005 greatly contributed to this difference for bark-foraging birds. We recorded a higher detection rate for cavity nesting species at unburned points and a higher detection rate for non-cavity nesting species at burned points, a pattern opposite that observed during the summer. Few hawking or priority species were observed during the winter.

The pattern of winter detection rates for management indicator species was similar to the summer pattern. Hairy Woodpeckers in the winter were more common at burned points (0.37 ± 0.09) than at unburned points (0.24 ± 0.07), although there is overlap in confidence intervals. Pygmy Nuthatches were more numerous at unburned points (0.16 ± 0.07) than at burned points (0.01 ± 0.02).

The average detection rate was 4.47 ± 0.59 birds per point during the winter of 2004-2005, a substantial increase from 3.40 ± 0.47 in 2002-2003 and 2.57 ± 0.46 in

2003-2004. We do not include data from 2001-2002, because we conducted fewer surveys during that winter. The emergence of Red Crossbills and Pine Siskins (*Carduelis pinus*), along with the large increase for all nuthatch species, contributing to the relative high abundance in winter 2004-2005.

We documented 21 species in burned habitat at least once during winter surveys in 2004-2005; another 6 species recorded during that time were not documented in burned habitat (Appendix 6). Pine Siskins (33 of 53, 62%) and Western Bluebirds (38 of 74, 51%) were among the most common species with at least half of observations in burned habitat. Golden-crowned Kinglets (*Regulus satrapa*, 0 of 8) and Brown Creepers (0 of 7) were among the winter species recorded only in unburned habitat. Dark-eyed Juncos were more frequent in burned habitat in the winter (192 of 410 observations, 47%) than in the summer (71 of 318, 22%).

We did not detect any rare or vagrant species during the winter. Notable observations included occasional Northern Pygmy-Owls (*Glaucidium gnoma*), some of which occurred in burned habitat. We also found several Eastern Bluebirds (*Sialia sialia*), an eastern species with a winter range extending to New Mexico.

DISCUSSION

Our results indicate that many species used early successional habitat produced by the Scott Able fire in the Lincoln National Forest. The addition of early successional habitat after a forest fire attracts a new assemblage of species, and most coniferous species will persist if a portion of the habitat remains unburned. Therefore, overall species richness might be greater after a fire than before (Hutto 1995, Huff et al. 1985). Although we have no pre-fire baseline detection rates and species richness information, the Scott Able fire likely facilitated the population growth we observed for many species (e.g., House Wren, Green-tailed Towhee, and MacGillivray's Warbler), and perhaps helped establish populations for some species (e.g., Purple Martin, Rock Wren) at our sites. Our data at unburned points indicate that these species, among others, were probably relatively uncommon or absent from our study sites before the fire. A portion of Pendleton was burned many years before the Scott Able fire and might offer a preview of what to expect in a later successional stage. Because both summer and winter species richness were highest at Pendleton, it is possible that species richness will be high for many years to come at the other sites burned by the Scott Able fire.

Many of our observations of rare or vagrant species were associated with burned habitat. Three-toed Woodpecker distribution in North America generally coincides with spruce (*Picea* spp.) forests and insect outbreaks due to large-scale disturbances, such as fire (Leonard 2001). In New Mexico, they have been described as rare to locally fairly common in spruce-fir mountains south to the Mogollon and Sacramento Mountains (Hubbard 1978); however, there were few records of Three-toed Woodpeckers in the Lincoln National Forest before the Scott Able fire (USDA Forest Service 1997). Our eight observations in burned areas in 2002 indicate that the Scott Able fire improved habitat for the Three-toed Woodpecker. Decreased numbers in 2004 and 2005 might indicate a reversal of the insect outbreak. Hoyt and Hannon (2002) stated that "recently burned forests likely represent suitable habitat for Three-toed Woodpeckers between 0 and 3 years post-fire, after which bark beetle abundance decreases." Because the Lincoln National Forest is at the southern edge of its range, Three-toed Woodpeckers might move out of our sites entirely when insect abundance decreases in burned areas.

We found considerable differences in detection rates between burned and unburned points within foraging and nesting guilds. Bark-foraging species (e.g., woodpeckers) and ground-foraging granivores (e.g., juncos) often respond positively to fire due to increases in food resources (Amman and Ryan 1991, Hutto 1995, Rotenberry et al. 1995, Finch et al. 1997), whereas foliage-gleaning species often respond negatively to fires in the years immediately following disturbance (Blake 1982). Our detection rates supported this pattern for ground and foliage-gleaning species in both seasons, but they did not support the pattern for bark-foraging species. Although some bark-foraging species were more common in burned habitat, the abundance of certain species largely confined to unburned habitat (e.g., nuthatches) offset this, particularly during winter surveys.

Snags at our sites provided nesting or roosting opportunities for cavity species and hunting perches for hovering or hawking species, resulting in high summer detection rates for these groups at burned points. We observed numerous Violet-green Swallows and Western Bluebirds perched on snags and very few away from snags. Snag quality also can influence use of burned areas by timber drilling species (Hutto 1995, Nappi et al. 2003), depending on burn severity and stand conditions prior to the fire (Horton and Mannan 1988, Nappi et al. 2003). We frequently observed Hairy Woodpeckers, a management indicator species, tapping on or drilling into snags. We also observed several species, including Pygmy Nuthatches, another management indicator species, nesting in cavities within snags. Because some species use snags, and even depend on them (Morissette et al. 2002), we recommend that land managers develop post-fire management plans that include some limits to snag removal.

We do not necessarily suggest that land managers avoid removing snags entirely; there are economic (i.e., salvage timber harvest) and public safety (i.e., risk of injury when weakened snags fall) issues that should be balanced with wildlife management. Some snags might be more important for birds than others. In the winter, abundance for cavity species was higher at unburned points; leaving snags in close proximity to unburned habitat, rather than in isolated patches, might provide better conditions for some cavity species. To further guide land managers, such as the USDA Forest Service, more study is needed on the relative value of different snag sizes and densities to different groups of birds, particularly species of conservation concern. In addition to songbirds, the use of different snag sizes and densities by the variety of small owls in the Lincoln Forest (e.g., Northern Pygmy-Owl) is a relatively understudied and intriguing topic. Hawks Aloft could perform such a study.

We observed changes in seasonal detection rates among some years, but overall abundance from 2002 to 2005 showed little change. It is probably too soon to identify meaningful population trends in the wake of the fire, considering the variety of factors that could influence abundance. The final winter and summer surveys marked the emergence of Red Crossbills and Pine Siskins, indicative of an increased cone crop. The increase in precipitation also might have contributed to the high abundance we observed during the final winter and summer surveys.

Because different species and guilds respond differently to changing habitat after a wildfire, detection rates for individual species or groups are more informative than overall rates. Species using scrub vegetation, such as Green-tailed Towhee and MacGillivray's Warbler, will likely continue the steady increase that we documented, at least for a number of years. Species using snags might also continue to increase, but their trends might reverse sooner, as snags fall and become increasingly scarce. In the more distant future, trends for coniferous species are expected to increase, as birds move into previously burned, but regenerating, areas. An appropriate research topic would be to document when these, and other, changes occur. Although it is perhaps impractical to monitor annually for such an extended period of time, these sites could be revisited periodically (e.g., every five years) to document changes in vegetation and associated birds. Hawks Aloft could perform such follow-up efforts.

Although the Scott Able fire was an intense crown fire, destroying many acres of coniferous forest, we found that many bird species either tolerated or benefited from the habitat modification. We observed most species at least once in burned habitat, and several priority and management indicator species regularly used burned habitat. Also, forest songbirds are known to use regrowth in clear-cuts in eastern deciduous forests for food and protection from predators during the post-breeding period (Anders et al. 1998). Forest songbirds could use post-fire scrub habitat in western forests in the same way, although post-breeding data in these forests are lacking. We do not discount the importance of wildfire prevention, especially when human lives and property are threatened; however, our observations demonstrate some benefits of such a fire. Because of the positive effects of intense fire on multiple species guilds, managers should consider wildfires, like the Scott Able fire, to be of some benefit to the avian community, despite the perceived negative effects.

SUMMARY OF RECOMMENDATIONS

- 1. Continue to survey sites as often as funding levels allow. We recommend revisiting sites and conducting surveys at least every five years to document changes in vegetation and associated changes in detection rates for foraging and nesting guilds, as well as for early successional species identified in this report.
- 2. Conduct a study to determine the relative value of snag sizes, densities, and configurations within the landscape to different bird species.
- 3. Our study design focused on diurnal species, particularly songbirds, and another concurrent Hawks Aloft study focused on Mexican Spotted Owls. The Lincoln National Forest hosts a variety of other nocturnal owls that are relatively understudied. We recommend a study to document how these species use different types of burned and unburned habitat.

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Figure 1. Location of point count survey sites at Little Lewis, Pendleton, Potato-Pepper, Seep, Wayland, and Woods in the Lincoln National Forest, Otero County, New Mexico.



Figure 2. Average detection rates (birds per point) and 95% confidence intervals for summer point count surveys at six sites in the Lincoln National Forest, New Mexico from 2002 to 2005.





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Figure 4. Annual summer detection rates (birds per point) and 95% confidence intervals from 2002 to 2005 at points classified as burned, unburned, and mixed in the Lincoln National Forest, New Mexico.



Figure 5. Annual summer detection rates (birds per point) and 95% confidence intervals from 2002 to 2005 for foraging and nesting guilds, and for priority species at points classified as unburned in the Lincoln National Forest, New Mexico.

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Figure 6. Annual summer detection rates and 95% confidence intervals for select species using successional habitat from 2002 to 2005 at the Lincoln National Forest, New Mexico.

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Figure 7. Average detection rates (birds per point) and 95% confidence intervals for winter point count surveys at six sites in the Lincoln National Forest, New Mexico from 2002 to 2005.



Figure 8. Average winter detection rates (birds per point) and 95% confidence intervals among foraging and nesting guilds, and priority species at points classified as burned, unburned, and mixed in the Lincoln National Forest, New Mexico from 2002 to 2005.

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Appendix 1. Location and classification of points surveyed in the Lincoln National Forest, New Mexico. Coordinates were recorded in North American Datum 27, Zone 13S. We considered burned points to be those with >90% of habitat burned within 100 m of the point. We considered unburned points to be those with >90% of habitat unburned within 100 m of the point. All other points were classified as mixed.

Route	Point	Easting	Northing	Burn Classification
Little Lewis	1	450790	3625540	Mixed
Little Lewis	2	450559	3625416	Mixed
Little Lewis	3	450305	3625479	Unburned
Little Lewis	4	450067	3625535	Mixed
Little Lewis	5	449799	3625527	Unburned
Little Lewis	6	449537	3625558	Mixed
Little Lewis	7	449291	3625498	Mixed
Little Lewis	8	449067	3625374	Mixed
Little Lewis	9	448849	3625242	Mixed
Little Lewis	10	448607	3625182	Unburned
Little Lewis	11	448361	3625222	Mixed
Little Lewis	12	448118	3625195	Mixed
Little Lewis	13	447892	3625084	Mixed
Little Lewis	14	447629	3625065	Burned
Little Lewis	15	447374	3625057	Burned
Little Lewis	16	447127	3625081	Burned
Pendleton	1	441163	3624838	Unburned
Pendleton	2	441414	3525153	Unburned
Pendleton	3	441627	3625473	Unburned
Pendleton	4	441777	3625839	Mixed
Pendleton	5	441755	3626214	Mixed
Pendleton	6	441961	3626573	Mixed
Pendleton	7	441993	3626981	Mixed
Pendleton	8	442137	3627349	Mixed
Pendleton	9	442137	3627349	Unburned
Pendleton	10	442771	3627667	Mixed
Pendleton	11	443113	3627458	Mixed
Pendleton	12	443016	3627053	Burned
Potato-Pepper	1	441527	3627214	Mixed
Potato-Pepper	2	441189	3626991	Burned
Potato-Pepper	3	440818	3626795	Burned
Potato-Pepper	4	440503	3626539	Mixed
Potato-Pepper	5	440238	3626230	Mixed
Potato-Pepper	6	440002	3625895	Mixed

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Route	Point	Easting	Northing	Burn Classification
Potato-Pepper	7	439741	3625588	Mixed
Potato-Pepper	8	439382	3625387	Mixed
Potato-Pepper	9	439035	3625594	Unburned
Potato-Pepper	10	438655	3625752	Unburned
Potato-Pepper	11	438655	3625752	Unburned
Potato-Pepper	13	438955	3625251	Burned
Potato-Pepper	14	438555	3625164	Burned
Potato-Pepper	15	438191	3624998	Burned
Potato-Pepper	16	437853	3624761	Burned
Potato-Pepper	17	437644	3624229	Burned
Seep	1	449954	3626565	Mixed
Seep	2	449595	3626799	Mixed
Seep	3	449281	3627054	Burned
Seep	4	449038	3627388	Burned
Seep	5	448634	3627433	Burned
Seep	6	448278	3627211	Burned
Seep	7	447896	3627026	Burned
Seep	8	447573	3626796	Mixed
Seep	9	447213	3626499	Mixed
Seep	10	446877	3626204	Unburned
Seep	11	446512	3626028	Unburned
Seep	12	446139	3625841	Unburned
Seep	13	445736	3625747	Unburned
Seep	14	445381	3625551	Unburned
Seep	15	444990	3625461	Unburned
Seep	16	444564	3625571	Unburned
Wayland	1	441006	3626131	Burned
Wayland	2	440851	3625929	Mixed
Wayland	3	440720	3625715	Unburned
Wayland	4	440501	3625598	Mixed
Wayland	5	440395	3625372	Mixed
Wayland	6	440243	3625140	Mixed
Wayland	7	440090	3624953	Mixed
Wayland	8	439897	3624765	Mixed
Wayland	9	439667	3624687	Mixed
Wayland	10	439442	3624550	Mixed
Wayland	11	439258	3624383	Mixed
Wayland	12	439104	3624179	Mixed
Wayland	13	439015	3623958	Mixed

Appendix 1 Continued.

	D 1			
Route	Point	Easting Northing Burn		Burn Classification
Wayland	14	438798	3623820	Mixed
Wayland	15	438609	3623662	Mixed
Wayland	16	438466	3623178	Mixed
Woods	1	433518	3623165	Unburned
Woods	2	433175	3623056	Unburned
Woods	3	433175	3622858	Unburned
Woods	4	433187	3622603	Mixed
Woods	5	433133	3622360	Burned
Woods	6	433081	3622124	Burned
Woods	7	432987	3621890	Burned
Woods	8	432942	3621676	Burned
Woods	9	432806	3621893	Burned
Woods	10	432657	3622086	Burned
Woods	11	432520	3622298	Mixed
Woods	12	432445	3622536	Unburned
Woods	13	432279	3622723	Unburned
Woods	14	432152	3622937	Unburned
Woods	15	432173	3623195	Unburned
Woods	16	432044	3623372	Unburned

Appendix 1 Continued.

Appendix 2. Species classification based on foraging guilds, nesting guilds, and priority
ranking. Foraging guilds include bark-foraging (B), hovering or hawking (H), foliage-
gleaning (F), and ground species (G). Priority species include those with New Mexico
Partners In Flight scores of >19 (New Mexico Partners In Flight 2003).

	Fo	Foraging Guilds			Nest		
Species	В	Η	F	G	Cavity	Non-cavity	Priority
Turkey Vulture						Х	
Northern Goshawk						Х	
Red-tailed Hawk						Х	
Golden Eagle						Х	
American Kestrel					Х	Х	
Wild Turkey				Х		Х	
Montezuma Quail				Х		Х	Х
Scaled Quail				Х		Х	Х
Band-tailed Pigeon						Х	
Mourning Dove				Х		Х	
Great Horned Owl						Х	
Flammulated Owl					Х		Х
Northern Pygmy-Owl					Х		
Northern Saw-whet Owl					Х		
Common Nighthawk		Х				Х	Х
Black-chinned Hummingbird						Х	Х
Rufous Hummingbird						Х	
Broad-tailed Hummingbird						Х	
Northern Flicker				Х	Х		
Acorn Woodpecker	Х				Х		
Downy Woodpecker	Х				Х		
Hairy Woodpecker	Х				Х		
Three-toed Woodpecker	Х				Х		
Red-naped Sapsucker	Х				Х		Х
Williamson's Sapsucker	Х				Х		
Olive-sided Flycatcher		Х				Х	
Western Wood-Pewee		Х				Х	Х
Dusky Flycatcher		Х				Х	
Cordilleran Flycatcher		Х				Х	
Say's Phoebe		Х				Х	
Ash-throated Flycatcher		Х			Х		
Cassin's Kingbird		Х				Х	Х
Plumbeous Vireo			Х			Х	
Warbling Vireo			Х			Х	Х
Steller's Jay				Х		Х	
American Crow						Х	
Common Raven						Х	
Chihuahuan Raven						Х	
Cliff Swallow		Х			Х		

	Foraging Guilds		Nest				
Species	В	H	F	G	Cavity	Non-cavity	Priority
Violet-green Swallow		Х			Х		Х
Tree Swallow		Х			Х		
Purple Martin		Х			Х		
Mountain Chickadee			Х		Х		
Bushtit	Х					Х	
White-breasted Nuthatch	Х				Х		
Red-breasted Nuthatch	Х				Х		
Pygmy Nuthatch	Х				Х		
Brown Creeper	Х					Х	
House Wren				Х	Х		
Bewick's Wren				Х	Х		
Rock Wren				Х	Х		
Golden-crowned Kinglet		Х				Х	
Ruby-crowned Kinglet		Х				Х	
Mountain Bluebird		Х			Х		Х
Western Bluebird		Х			Х		
Eastern Bluebird		Х			Х		
Townsend's Solitaire		Х				Х	
American Robin				Х		Х	
Hermit Thrush				Х		Х	
Northern Mockingbird				Х		Х	
Orange-crowned Warbler			Х			Х	
Virginia's Warbler			Х			Х	Х
Townsend's Warbler		Х				Х	
Yellow-rumped Warbler		Х				Х	
Grace's Warbler		Х				Х	Х
MacGillivary's Warbler			Х			Х	
Wilson's Warbler			Х			Х	
Hooded Warbler			Х			Х	
Kentucky Warbler			Х			Х	
Hepatic Tanager			Х			Х	
Western Tanager			Х			Х	
Blue Grosbeak			Х			Х	
Black-headed Grosbeak			Х			Х	
Spotted Towhee				Х		Х	
Green-tailed Towhee				Х		Х	
Chipping Sparrow				Х		Х	
White-crowned Sparrow				Х		Х	
Dark-eyed Junco				Х		Х	
Indigo Bunting			Х			Х	
Red-winged Blackbird				Х		Х	
Brown-headed Cowbird						Х	
Red Crossbill			Х			Х	

Appendix 2 Continued.

rppendix 2 continued.							
	Foraging Guilds		Nesting Guilds				
Species	В	Η	F	G	Cavity	Non-cavity	Priority
Evening Grosbeak				Х		Х	
House Finch				Х		Х	
Lesser Goldfinch			Х			Х	
Pine Siskin			Х			Х	

Appendix 2 Continued.

Appendix 3. Species and number of individuals observed during summer point cour	nts at
Little Lewis (LL), Pendleton (PE), Potato-Pepper (PP), Seep (SE), Wayland (WA),	, and
Woods (WO) in the Lincoln National Forest, New Mexico from 2002 to 2005. T	otals
include individuals at all distances from the point, but do not include flyovers.	

Species	LL	PE	PP	SE	WA	WO	Total
Turkey Vulture	0	0	4	2	1	0	7
Northern Goshawk	1	0	0	0	0	0	1
Red-tailed Hawk	2	11	7	2	2	0	24
American Kestrel	4	1	4	4	0	9	22
Wild Turkey	4	1	2	2	0	0	9
Montezuma Quail	0	0	0	2	0	0	2
Scaled Quail	0	0	2	0	0	0	2
Band-tailed Pigeon	0	0	0	0	1	0	1
Mourning Dove	20	28	35	27	17	43	170
Great Horned Owl	0	0	0	0	2	0	2
Flammulated Owl	0	0	0	1	0	0	1
Northern Pygmy-Owl	3	1	0	0	0	0	4
Northern Saw-whet Owl	0	0	1	0	0	0	1
Common Nighthawk	1	0	0	0	0	0	1
Black-chinned Hummingbird	2	1	3	5	1	4	16
Rufous Hummingbird	0	1	0	0	0	0	1
Broad-tailed Hummingbird	20	53	74	34	64	24	269
Acorn Woodpecker	7	4	2	21	0	0	34
Northern Flicker	38	34	74	48	43	45	282
Downy Woodpecker	8	1	11	10	3	6	39
Hairy Woodpecker	87	43	90	92	72	84	468
Three-toed Woodpecker	1	0	1	0	2	8	12
Red-naped Sapsucker	1	0	1	0	0	0	2
Williamson's Sapsucker	1	0	0	1	0	0	2
Olive-sided Flycatcher	4	1	3	2	4	3	17
Western Wood-Pewee	18	25	21	27	10	18	119
Dusky Flycatcher	1	11	0	1	0	0	13
Cordilleran Flycatcher	9	27	29	8	36	23	132
Say's Phoebe	3	3	3	3	0	0	12
Ash-throated Flycatcher	9	6	1	17	0	1	34
Cassin's Kingbird	8	15	2	45	1	0	71
Plumbeous Vireo	29	18	23	28	33	23	154
Warbling Vireo	2	23	24	6	120	149	324
Steller's Jay	75	44	91	49	105	10	374
Common Raven	16	7	7	25	3	5	63
Chihuahuan Raven	0	1	0	0	0	4	5
Tree Swallow	0	0	1	0	0	0	1
Violet-green Swallow	7	176	43	6	11	206	449
Purple Martin	0	17	17	9	0	29	72
Mountain Chickadee	37	45	71	98	123	109	483

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Species	LL	PE	PP	SE	WA	WO	Total
Bushtit	23	1	0	13	8	0	45
Brown Creeper	27	4	7	22	19	13	92
White-breasted Nuthatch	107	37	53	78	37	47	359
Red-breasted Nuthatch	6	0	18	5	27	22	78
Pygmy Nuthatch	19	14	3	7	4	20	67
House Wren	234	118	286	143	204	164	1149
Bewick's Wren	0	1	0	0	0	0	1
Rock Wren	2	2	21	13	0	0	38
Golden-crowned Kinglet	2	2	5	0	2	37	48
Ruby-crowned Kinglet	0	0	0	0	0	24	24
Western Bluebird	53	30	74	100	20	127	404
Mountain Bluebird	0	3	0	6	2	8	19
Townsend's Solitaire	0	1	2	0	0	5	8
Hermit Thrush	7	6	4	32	15	41	105
American Robin	61	73	161	85	235	59	674
Northern Mockingbird	0	1	1	6	0	0	8
Orange-crowned Warbler	0	7	4	0	13	2	26
Virginia's Warbler	0	10	4	0	10	0	24
Yellow-rumped Warbler	31	22	29	67	69	195	413
Townsend's Warbler	0	0	0	0	1	0	1
Grace's Warbler	50	16	7	37	18	10	138
MacGillivray's Warbler	0	20	29	0	22	0	71
Kentucky Warbler	0	1	0	0	0	0	1
Wilson's Warbler	1	1	0	0	0	0	2
Hooded Warbler	0	1	0	0	0	0	1
Hepatic Tanager	4	1	0	2	1	0	8
Western Tanager	93	53	100	133	107	46	532
Green-tailed Towhee	27	115	75	63	13	24	317
Spotted Towhee	4	5	4	20	2	0	35
Chipping Sparrow	10	0	6	20	2	1	39
White-crowned Sparrow	0	1	0	0	0	0	1
Dark-eyed Junco	151	157	223	186	295	140	1152
Black-headed Grosbeak	15	25	10	11	30	3	94
Blue Grosbeak	0	0	0	1	0	0	1
Indigo Bunting	0	0	2	2	0	0	4
Red-winged Blackbird	0	0	1	0	0	0	1
Brown-headed Cowbird	2	8	0	3	0	0	13
Bullock's Oriole	0	1	0	0	0	0	1
Red Crossbill	1	0	12	0	0	3	16
House Finch	0	4	2	2	0	11	19
Pine Siskin	6	4	22	11	14	27	84
Lesser Goldfinch	3	0	0	8	8	4	23
Evening Grosbeak	0	0	32	0	0	0	32
Total Species	54	60	58	55	47	44	83

Appendix 3 Continued.

Appendix 4. Species and number of individuals observed during winter point counts at Little Lewis (LL), Pendleton (PE), Potato-Pepper (PP), Seep (SE), Wayland (WA), and Woods (WO) in the Lincoln National Forest, New Mexico from 2002 to 2005. Totals include individuals at all distances from the point, but do not include flyovers.

Species	LL	PE	PP	SE	WA	WO	Total
Red-tailed Hawk	2	3	4	4	5	2	20
Golden Eagle	0	0	0	0	1	0	1
American Kestrel	3	0	0	2	0	0	5
Wild Turkey	0	10	8	8	7	0	33
Band-tailed Pigeon	0	0	0	0	22	0	22
Mourning Dove	0	1	0	1	2	0	4
Northern Pygmy-Owl	0	1	3	0	1	0	5
Northern Saw-whet Owl	0	0	0	1	0	0	1
Acorn Woodpecker	0	3	2	3	0	0	8
Northern Flicker	14	7	6	7	6	8	48
Downy Woodpecker	8	1	5	2	6	5	27
Hairy Woodpecker	64	34	64	37	49	40	288
Red-naped Sapsucker	0	0	0	1	0	0	1
Williamson's Sapsucker	2	2	0	2	0	3	9
Steller's Jay	28	18	44	11	57	14	172
American Crow	0	0	1	0	1	0	2
Common Raven	5	2	6	1	4	20	38
Mountain Chickadee	40	41	43	50	108	96	378
Brown Creeper	2	4	2	2	5	7	22
White-breasted Nuthatch	64	32	42	37	42	41	258
Red-breasted Nuthatch	3	10	14	7	33	24	91
Pygmy Nuthatch	15	12	17	13	23	14	94
Ruby-crowned Kinglet	0	1	0	1	0	0	2
Golden-crowned Kinglet	6	5	1	0	4	5	21
Eastern Bluebird	5	0	0	0	0	0	5
Western Bluebird	0	4	18	0	14	11	47
Mountain Bluebird	0	0	0	0	0	3	3
Townsend's Solitaire	0	0	0	1	0	0	1
American Robin	7	6	5	3	3	3	27
Green-tailed Towhee	0	1	0	0	0	0	1
Dark-eyed Junco	205	136	220	225	242	103	1131
White-crowned Sparrow	0	1	0	0	0	0	1
Red Crossbill	15	21	11	0	8	2	57
Pine Siskin	10	4	0	1	9	23	47
Total Species	19	25	20	23	23	19	34

Appendix 5. Minimum number of observations for each species in burned habitat during summer point count surveys in the Lincoln National Forest, New Mexico in 2004 and 2005. Totals include individuals at all distances from the point, but do not include flyovers.

Species	Scientific Name	# in Burn	Total #	Percent
Violet-green Swallow	Tachycineta thalassina	198	198	100%
Evening Grosbeak	Coccothraustes vespertinus	21	21	100%
Montezuma Quail	Cyrtonyx montezumae	3	3	100%
Williamson's Sapsucker	Sphyrapicus thyroideus	2	2	100%
Blue Grosbeak	Guiraca caerulea	1	1	100%
Great Horned Owl	Bubo virginianus	1	1	100%
Kentucky Warbler	Oporornis formosus	1	1	100%
Wilson's Warbler	Wilsonia pusilla	1	1	100%
Purple Martin	Progne subis	55	59	93%
American Kestrel	Falco sparverius	14	18	78%
Western Bluebird	Sialia mexicana	202	270	75%
Rock Wren	Salpinctes obsoletus	31	44	70%
Indigo Bunting	Passerina cyanea	2	3	67%
Lesser Goldfinch	Carduelis psaltria	2	3	67%
Acorn Woodpecker	Melanerpes formicivorus	22	34	65%
Green-tailed Towhee	Pipilo chlorurus	182	286	64%
Spotted Towhee	Pipilo maculatus	10	16	63%
House Wren	Troglodytes aedon	523	895	58%
Brown-headed Cowbird	Molothrus ater	3	6	50%
Three-toed Woodpecker	Picoides tridactylus	1	2	50%
Hairy Woodpecker	Picoides villosus	112	245	46%
Downy Woodpecker	Picoides pubescens	9	20	45%
Cassin's Kingbird	Tyrannus vociferans	34	76	45%
Red-tailed Hawk	Buteo jamaicensis	9	21	43%
Pine Siskin	Carduelis pinus	20	48	42%
Western Wood-Pewee	Contopus sordidulus	36	88	41%
Townsend's Solitaire	Myadestes townsendi	2	5	40%
Ash-throated Flycatcher	Myiarchus cinerascens	5	13	38%
MacGillivray's Warbler	Oporornis tolmiei	20	57	35%
Olive-sided Flycatcher	Contopus cooperi	4	12	33%
Say's Phoebe	Sayornis saya	2	6	33%
Band-tailed Pigeon	Columba fasciata	1	3	33%
Mourning Dove	Zenaida macroura	27	84	32%
Northern Flicker	Colaptes auratus	90	281	32%
Virginia's Warbler	Vermivora virginiae	3	11	27%
Northern Pygmy-Owl	Glaucidium gnoma	1	4	25%
White-breasted Nuthatch	Sitta carolinensis	54	229	24%
Chipping Sparrow	Spizella passerina	7	30	23%
Dark-eyed Junco	Junco hyemalis	117	659	18%
Pygmy Nuthatch	Sitta pygmaea	5	31	16%

Species	Scientific Name	# in Burn	Total #	Percent
Broad-tailed Hummingbird	Selasphorus platycercus	22	141	16%
Wild Turkey	Meleagris gallopavo	2	15	13%
Steller's Jay	Cyanocitta stelleri	44	334	13%
Dusky Flycatcher	Empidonax oberholseri	1	8	13%
Hepatic Tanager	Piranga flava	1	8	13%
Black-headed Grosbeak	Pheucticus melanocephalus	5	41	12%
Yellow-rumped Warbler	Dendroica coronata	22	223	10%
Bushtit	Psaltriparus minimus	3	32	9%
Common Raven	Corvus corax	6	71	8%
American Robin	Turdus migratorius	40	512	8%
Orange-crowned Warbler	Vermivora celata	1	17	6%
Cordilleran Flycatcher	Empidonax occidentalis	5	100	5%
Western Tanager	Piranga ludoviciana	11	310	4%
Mountain Chickadee	Poecile gambeli	6	281	2%
Warbling Vireo	Vireo gilvus	2	219	1%
Plumbeous Vireo	Vireo plumbeus	1	126	1%
Hermit Thrush	Catharus guttatus	0	133	0%
Grace's Warbler	Dendroica graciae	0	104	0%
Red-breasted Nuthatch	Sitta canadensis	0	62	0%
Brown Creeper	Certhia americana	0	36	0%
Golden-crowned Kinglet	Regulus satrapa	0	23	0%
Red Crossbill	Loxia curvirostra	0	20	0%
Ruby-crowned Kinglet	Regulus calendula	0	8	0%
Cliff Swallow	Petrochelidon pyrrhonota	0	2	0%
Red-winged Blackbird	Agelaius phoeniceus	0	2	0%
Townsend's Warbler	Dendroica townsendi	0	2	0%
Turkey Vulture	Cathartes aura	0	2	0%
Flammulated Owl	Otus flammeolus	0	1	0%
Hooded Warbler	Wilsonia citrina	0	1	0%
House Finch	Carpodacus mexicanus	0	1	0%
White-crowned Sparrow	Zonotrichia leucophrys	0	1	0%

Appendix 5 Continued.

Species	Scientific Name	# in Burn	Total #	Percent
Band-tailed Pigeon	Columba fasciata	22	22	100%
Eastern Bluebird	Sialia sialis	5	5	100%
Downy Woodpecker	Picoides pubescens	8	10	80%
American Kestrel	Falco sparverius	3	4	75%
Pine Siskin	Carduelis pinus	33	53	62%
Acorn Woodpecker	Melanerpes formicivorus	3	5	60%
Western Bluebird	Sialia mexicana	38	74	51%
Ruby-crowned Kinglet	Regulus calendula	1	2	50%
Red-tailed Hawk	Buteo jamaicensis	8	17	47%
Dark-eyed Junco	Junco hyemalis	192	410	47%
Northern Flicker	Colaptes auratus	13	28	46%
Hairy Woodpecker	Picoides villosus	59	154	38%
Williamson's Sapsucker	Sphyrapicus thyroideus	1	4	25%
Common Raven	Corvus corax	21	97	22%
White-breasted Nuthatch	Sitta carolinensis	29	142	20%
Northern Pygmy-Owl	Glaucidium gnoma	2	11	18%
Steller's Jay	Cyanocitta stelleri	24	192	13%
Red Crossbill	Loxia curvirostra	10	115	9%
Pygmy Nuthatch	Sitta pygmaea	3	76	4%
Red-breasted Nuthatch	Sitta canadensis	1	65	2%
Mountain Chickadee	Poecile gambeli	1	181	1%
Golden-crowned Kinglet	Regulus satrapa	0	8	0%
Brown Creeper	Certhia americana	0	7	0%
American Robin	Turdus migratorius	0	4	0%
Mountain Bluebird	Sialia currucoides	0	1	0%
American Crow	Corvus brachyrhynchos	0	1	0%
Wild Turkey	Meleagris gallopavo	0	1	0%

Appendix 6. Minimum number of observations for each species in burned habitat during winter point count surveys in the Lincoln National Forest, New Mexico in 2004-2005. Totals include individuals at all distances from the point, but do not include flyovers.