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Conservation of Post-fire Habitat, Black-Backed Woodpeckers and Other Bird Species on the Lolo National Forest

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INTRODUCTION

The Forest Service directed by the National Forest Management Act to assess viability for all species at the planning level, which has been interpreted to be the National Forest level. Therefore, the entire Lolo National Forest is an appropriate scale to address issues relating to post-fire habitat and viability of black-backed woodpeckers. Post-fire habitat is defined as habitat resulting from a mixed lethal or stand-replacement fire that produces an abundance of snags. Black-backed woodpeckers are also a sensitive species in R1 and the Forest Service is directed (FSM 2670.32) to "avoid or minimize impacts to species whose viability has been identified as a concern". Black-backed woodpeckers are not the only species associated with post fire habitat or stands of mountain pine beetle mortality, however because they are considered Sensitive, they are a good focal species for this habitat.

Most research on black-backed woodpeckers indicates that they are dependent upon fires, particularly in the Northern Rockies (Hutto 1995, Caton 1996, Hitchcock 1996, Murphy and Lehnhausen 1998, Saab and Dudley 1998, Hejl and McFadzen 2000). Black-backed woodpeckers are found in unburned forests and also in areas of insect outbreaks (Marshall 1992), but they likely occur at lower densities and viability may not be maintained over time without sufficient post-fire habitat. For example, one study estimated home ranges for black-backed woodpeckers in beetle killed forests at 1,000 acres, as compared to the observation of 9 pairs of black-backed woodpeckers holding territories in approximately 500 acres of post fire habitat (approximately 56 acres/pair; Powell, 2000). Many studies indicate that black-backed woodpeckers forage primarily on wood-borers, which may explain this difference in suitability between beetle outbreaks and post-fire habitat because wood-borers are much less abundant than bark beetles in areas of bark beetle outbreaks (Powell 2000). However, it is unclear whether black-backed woodpeckers only forage on wood-borers or if they will shift to other insects, i.e., bark beetles. Post fire habitat provides ideal foraging habitat for black-backed woodpeckers, however it is short-lived resource. Abundance of wood-borers begins to decline after three years and the value for large numbers of woodpeckers appears to significantly decline after 5-6 years (Caton 1996, Powell 2000). A good discussion of the foraging ecology of black-backed woodpeckers is in Powell

(2000). Hutto (1995) indicated that periodic fires may be critical for the long term viability of black-backed woodpeckers. Research has also indicated that salvage logging, even when large numbers of snags are left, is detrimental to this species (Saab and Dudley 1998, Hejl and McFadzen 2000). Hejl and McFadzan (2000) found that black-backed woodpeckers did not nest in areas that were considered lightly salvaged. All recent research has reinforced the sensitive status of this species and its habitat.

Since 1994, the Lolo N.F. has experienced several large fires that have burned a mosaic of burn intensities. There are many methods to map burn intensity, but most range from severely burned stands (stands with all trees dead) to areas that underburned with little overstory tree mortality. Studies by Hejl and McFadzan (2000) and others indicate that the severe burn intensity is the most valuable for black-backed woodpeckers, at least in the first 1 – 5 years post fire. Post-fire habitat has been identified in all recent watershed scale analyses on the Lolo N.F. as a rare or completely missing component of the landscape. All analyses have identified a need to create or retain some post-fire habitat on the landscape. The Lolo has an aggressive prescribed fire program, however the emphasis is in dry Douglas-fir/ponderosa pine types or in open grass/shrub habitat and although the amount of post-fire habitat is increasing, it still occurs at relatively small amounts at the Forest scale.

Looking at broad scale trends related to fire exclusion, conclusions from the science assessment for the Interior Columbia River Basin also lend support for this critical loss of post fire habitat (Quigley and Arbelbide 1997). Considering the three Potential Vegetation Group (PVGs) that occur on the Lolo N.F., Dry Forest PVG is clearly the most departed from historic fire regimes and historic vegetative conditions. Since the predominate fire regime in the Dry Forest PVG was low intensity, frequent fires, very little post fire habitat was created in this PVG. Cold Forest and Moist Forest PVG are also different than historic vegetative conditions in several ways. Moist Forest types historically were predominately mixed lethal, with some lethal crown fires and some non-lethal underburns. There has been a shift to more lethal burns, however there has also been a shift to longer fire return intervals due to successful fire suppression. Early seral habitat is slightly less abundant in Moist Forest PVG and Cool Forest PVG compared to what occurred historically. However, the structural integrity of early seral is very different that what occurred historically. Early seral habitat creating by logging (which is the greatest agent for early seral on the Lolo N.F.) does not have the standing dead component that early seral habitat created by fire has. This difference is critical when considering black-backed woodpeckers. Also, the distribution of this habitat across the landscape is very different.

Source habitats are areas that contribute to a stationary or positive population growth for a species in a specified area and time. Source habitat for black backed woodpeckers is considered to be a combination of old forests of subalpine, montane and lower montane forests and managed and unmanaged young forest stages of lodgepole pine (Wisdom et al. 2000). Burned forests and areas of large scale insect infestations are also important. Due to the substantial difference in nest success between black backed woodpeckers in Oregon during a bark beetle epidemic (68.5%) and in burned forests in 2 areas (Idaho and

Wyoming – 100%), burned forests are also considered as potentially important source habitats (Wisdom et al. 2000). Western Montana has experienced an estimated > 60% percent decline in source habitats. In this case, because recently burned forests were too fine of scale and too ephemeral, they were not estimated in this landscape analysis. This decline is primarily the loss of late seral lower montane and late seral montane forests and the loss of snags Interior Columbia River basin-wide due to timber harvest. Beetle outbreaks also have been altered by salvage logging.

Management strategies developed in Wisdom et al. (2000) for black-backed woodpeckers include maintaining existing old forests, accelerate development of old forests in younger stands, maintain stands that have experienced beetle outbreaks and stand replacement fire and restore fire as an ecological process.

FOREST SCALE ANALYSIS

After large fire events occur on a forest, as occurred in 1996, 1998 and 2000 on the Lolo, the question of rehabilitation and salvage occurs. In order to address this question in 1998, we developed an analysis technique to compare the existing amount of post-fire habitat with historic amounts of post-fire habitat that likely occurred on the forest at any given time. Given our emphasis in ecosystem management and comparison of historical stand conditions versus existing due to fire suppression, it makes sense to consider how existing amounts of post fire habitat compares to historic amounts of post fire habitat. This analysis follows Region 1 recommendations for black-backed woodpeckers (Mariani et al. 1994).

The first step was to assess the amount of acres on the Lolo that burned historically. Lozensky (1987) estimated that approximately 50,000 acres per year burned on the Lolo N.F. We wanted to validate this estimate and also determine how many acres would have underburned versus mixed lethal or stand replacement (and thus provide post-fire habitat). Fire groups were used to estimate fire intensity class. Fire groups 0 and 4 are low intensity fire regimes. Fire groups 7, 8, 9, and 11 typically experienced stand-replacing fires. Fire group 6 typically experienced a mixed fire regime in which some of the fires are low intensity and some are high. In order to categorize the acres of fire group 6 by intensity class, we used the following assumption. The fire frequency literature (Fischer and Bradley 1987) doesn't quantify the percentage of fire group 6 that is low or high intensity. We assumed 50% was low intensity and 50% was high.

An estimate of average acres was derived by mapping fire groups across the forest, summing acres by fire group, and estimating acres that burned per year in each fire group by using mean fire return intervals. For example, if there were 100,000 acres that had a mean fire return interval of 25 years, then over a 25-year period, we assumed all of the acres would have burned. Therefore, on average, 4000 acres burned per year. We recognize that in this fire group, 4,000 acres per year did not burn, some years none burned and some years many more acres than 4,000 burned. However to be able to compare current to historic conditions, we had to have some ballpark estimate of acres that burned. Overall, we estimated that there was a 40/60 split across the Lolo N.F. based

on mapped habitat types, with 40% of the stands experiencing primarily non-lethal burns and 60% experiencing primarily lethal burns.

A conservative estimate from these data suggests a range of annual burned acres on the Lolo N.F. of 32,618 to 62,798 acres. If we consider the extreme ranges, using maximum and minimum fire return intervals rather than mean fire return interval, the range of 18,071 to 211,764 is the absolute extreme of annual acres burned on the forest. For this assessment, the 32,618-62,798 acre range of total annual acres burned is most useful for historic comparison. Using existing habitat type data and mean fire return intervals, we estimated that an average of 56,269 acres per year burned on the forest, which is close to the 50,000 acres per year estimated by Losensky (1987)

We wanted to account for reburns in our estimate. Reburns are common in some habitat types, particularly lodgepole pine dominated forests. Since reburns don't result in post fire habitat suitable for black-backed woodpeckers (the trees are too small or are already dead), subtracting 50% of the acres of burned acres produced in fire groups 7/8 (primarily lodgepole pine types) gives a more reasonable estimate of historically available fire-killed dead produced by stand-replacing fires. This gives us a figure of 30,689 acres.

Therefore, we used the figure of 30,689 acres to represent the historic annual acres of stand-replacing fires that produced large amounts of post fire habitat. We recognize that this does not mean that each year, 30,689 acres of post fire habitat was produced on the Lolo N.F. However, the number is useful to be able to put existing fires into a historical context.

The next step in the analysis was to assess the current levels of post-fire habitat available on the Lolo N.F. Information needed included acres that have burned annually since fire suppression became effective (1930's) and acres of prescribed burned that might provide additional post-fire habitat. We also wanted to know of the acres burned, how many were salvaged in which the amount of fire-killed dead stands were further reduced? Also, we wanted to consider to what degree has increasing levels of mountain pine beetle outbreaks (MPB) offset the reduction of post-fire habitat.

The Lolo has accurate records for the acres of wildfires and the acres of prescribed fire treated from 1975 to 1998. This 24-year period can be used to represent the last 70 years of fires suppression (1930 to present) based on the following assumptions. The 24-year period (1975-1998) is a good sample for estimating acres of annual wildfire since suppression efforts became effective. The late '70's to the late '80's were a decade of drought. Other droughty summers followed, including the summer of '94, however, these drought years were interspersed with wetter summers (such as the summer of '93). Consequently, this sample period is probably at least as dry and volatile as previous decades. Fuel accumulation following the previous 5 decades of fire suppression was presumably increasing. Fires occurred during these droughty summers, when one would expect to experience very large wildfires under natural conditions.

Figure 1 displays the actual total acres burned each year from 1975 – 1998 on the Lolo

N.F. as compared to the historic total average acres that burned (56,269 acres) and the annual average amount of stand replacement fire (30,689 acres). The total acres burned since 1975 was 97,348 acres, or an average of 4,056 acres per year. This represents 13% of historic levels This 13% figure is primarily a result of one large fire in 1988 (Canyon Creek) and therefore, it is also useful to assess this percent without this one fire. Excluding this fire, the fires of the past 20 years represent 3% of historic levels. Therefore, we considered the fires from 1975 – 1998 to have occurred at a range of 3 – 13% of what occurred historically.

Use by black-backed woodpeckers peaks within 2-3 years after a burn, then declines, and they are rarely found after 5-7 years (Caton 1996, Murphy and Lehnhausen 1998). It is useful to consider the range of acres burned in the past six years. The total amount that burned from 1993 - 1998 was 11,045 acres. This represents the amount of post-fire habitat currently available (in 1998) for black-backed woodpeckers. This represents 6% of what would have occurred pre fire suppression during a comparable 6-year period.

We also considered prescribed burning as a source of post-fire habitat, however most of this was brush disposal after logging or burning in open bunchgrass communities and virtually no post-fire habitat was created. Therefore, this was not a significant source of post-fire habitat. The majority of those treatments were broadcast burns in regeneration units (about 50% of the total up to 1990), very low intensity underburns, or winter range burns in open grass/shrub communities. Burning done in 1997 and 1998, however, increased in acreage dramatically and started to include small amounts of post-fire. While the acres of post-fire habitat are as yet insignificant, they show a trend to creating more post-fire habitat through prescribed burning.

There was no way to assess the amount of salvage in post-fire habitat. Based on the broad definition of "salvage" there was no way to tease out the proportion of salvage acres that occurred after fires, or the amount of snags removed. We assumed the reduction in fire-killed dead availability (down to 3-13% of historic levels) places post-fire habitat dependent species and ecosystems at extreme risk. Even if no post-fire habitat was salvaged, those species are still at risk due to the loss of other source habitats as well as the effects of fire exclusion.

The amount of mountain pine beetle mortality in lodgepole pine is increasing across the forest and has value to black-backed woodpeckers. 50% of the lodgepole-dominated stands 60-140 years old will have significant mountain pine mortality within 40 years. Research by Goggins and others (1988) suggests these stands will provide habitat for black-backed woodpeckers. However, research by others (Powell 2000, Goggins and others 1988, Saab and Dudley 1998 and Hoffman 1997 reported in Wisdom et al. 2000) indicates that the value of these for nesting black-backed woodpeckers is less than the value of post fire habitat. This is based on three pieces of information:

1. nest success has been documented to be higher in post-fire habitat than in beetle killed stands.
2. Powell's (2000) limited surveys of mountain pine beetle stands in NW Montana

failed to detect any black-backed woodpeckers.

3. one study estimated home ranges of approximately 1000 acres for black-backed woodpeckers in beetle killed forests, as compared to the observation of 9 pairs of black-backed woodpeckers holding territories in approximately 500 acres of post fire habitat (which would be approximately 56 acres/pair; Powell, 2000).

We could not value acres of pine beetle mortality acre for acre, the same as post-fire habitat. Therefore, we estimated that beetle killed stands provide, at most, 25% of the value that post-fire habitat provides. In other words, 100 acres of beetle killed lodgepole is valued the same for black-backed woodpeckers as 25 acres of post-fire habitat. Current mountain pine beetle outbreaks across the Lolo are estimated to occur on an average of 3475 acres per year. Based on our assumption, this would be equivalent to 869 acres of post-fire habitat per year.

Conclusions of Forest-Scale Analysis

After considering this information, we developed the following conclusions about post-fire habitat and black-backed woodpeckers on the Lolo N.F.

1. At the large scale (Interior Columbia Basin), source habitat for black-backed woodpeckers has declined from historic amounts due to timber harvest and fire exclusion.
2. The availability of post-fire habitat on the Lolo N.F. (3-13% of historic amounts) is at extremely low levels. Post-fire habitat in the period 1993 – 1998 (the 6 years before 1998) is at 6% of historic levels. Even considering the active fire years of 1994 and 1998, post-fire habitat is still considerably less than historic amounts. Black-backed woodpeckers are clearly at risk.
3. The Lolo prescribed fire program has not demonstrated an ability to recruit large amounts of post-fire habitat, although there is an improving trend in 1997-98.
4. The 869 equivalent annual acres of anticipated mountain pine beetle mortality will improve the situation by 3%, adjusting the current availability of black-backed woodpecker habitat to 6-16% of prehistoric levels. However, it is also clear that insect killed stands do not mimic post-fire habitat because the process of fire is missing. Although some woodpeckers will use these stands, many other species that are found in post-fire habitat do not (morels, mountain bluebirds, brown creeper: Hejl and McFadzen 2000).
5. Therefore, any salvage of post-fire habitat would reduce the projected improving trend.

It is difficult to conclude that, with continued salvage of post-fire habitat, black-backed woodpeckers are not at some risk of federal listing. It is clear, however, that the level of post-fire habitat is increasing and will continue to do so with the combined effects of increasing fuel loads and hotter, larger wildfires, increasing levels of insect mortality, and an increased emphasis to restore stand-replacing fire though use of prescribed burns.

We concluded in 1998 that salvage of any post-fire habitat on the Lolo N.F. would lead to a determination of effect for black-backed woodpeckers of "will impact individuals or habitat and with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species." However, we also concluded that since the prescribed fire program was creating more and more post-fire habitat, we could mitigate for a loss of post-fire habitat due to salvage by a commitment to creation of post-fire habitat of an equal amount. Since most of our prescribed fire program where we create post-fire habitat is not in the suitable timber base and the fires considered for salvage were, this logic fit with the Lolo Forest Plan. We estimated that approximately 400 acres per year of post-fire habitat would be created in the next few years. Therefore, we agreed that if salvage was limited to 400 acres or less of post-fire habitat it would lead to a determination of "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species." Consequently, even though the effects of small amounts of salvage are negative, the cumulative outcome of that project and other planned activities is clearly positive.

This analysis was done before the 2000 fire season and therefore, did not take into account the effects of these fires on the Lolo N.F. Post fire analysis is currently underway and will consider the same type of analysis for the Lolo N.F. Although the argument can be made that our geographic area is too small and therefore, fires on the Bitterroot N.F. or in all of western Montana should be considered. For a broad scale assessment, this would be the case, however when considering the viability with the planning unit, as defined by the National Forest Management Act, it is reasonable to limit the assessment to the Lolo N.F. scale.

INDIVIDUAL FIRE ANALYSIS FOR A SALVAGE SALE

The Boyer fire that burned on the Plains Ranger District in 1998 gave a unique opportunity to assess post-fire habitat within one fire. The Boyer fire occurred in September 1998 and burned approximately 7120 acres, 3571 acres on Forest Service land. The fire burned approximately 1 mile northeast of the town of Plains, mostly in the Henry Creek drainage. After fire rehabilitation efforts were complete, an ID team was assembled to consider the possibility of salvaging some of the burned trees. Due to the broad landscape analysis provided by CRB and the forest scale analysis, we already knew that post-fire habitat was in critical supply across the forest and that harvest of more than 400 acres of post-fire habitat in the Boyer fire would be detrimental to black-backed woodpeckers and result in a "will impact individuals or habitat and with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species. Therefore, 400 acres or less of post-fire habitat would be salvaged in the Boyer fire.

One of the most challenging aspects of designing this salvage sale was deciding, within one fire, what was the best habitat for black-backed woodpeckers. The literature suggests that trees with bark burned off are of little value to insects and therefore woodpeckers (Murphy and Lehnhausen 1998). There were no stands in this condition in

Boyer. Even within the highest intensity burned areas, most trees had bark remaining. Areas with subalpine fir were the most likely to be in this condition and there were no stands of pure subalpine fir. The literature also suggests that western larch, Douglas-fir and ponderosa pine are more valuable than subalpine fire, spruce and lodgepole pine (Hutto 1995, Caton 1996, Hejl and McFadzan 2000). Most stands in Boyer were mixed species, with larch, Douglas-fir, grand fir and lodgepole pine common in most areas and ponderosa pine and Douglas-fir at the lower elevations. The literature gave no indication of patch size or density of snags needed. Indications from Hejl's (2000) ongoing research on bird use of post fire habitat in the Henry Peak fire (that occurred in 1994 in the same drainage as Boyer) were that salvage prescriptions that left 10-12 large snags per acre became unsuitable for nesting black-backed woodpeckers. It was not economical to leave significantly more trees and also salvage, therefore we used the same snag retention and assumed any salvaged areas would not be suitable habitat. The Boyer fire was mapped by burn intensity and by fire group. Fire intensities were as follows:

Intense – 90-100% tree mortality, needles and small limbs consumed, some large limbs consumed

High – 90-100% tree mortality, needles and small limbs not consumed

Moderate-High – 60-90% tree mortality, mostly dead stands with patches of live trees and scattered live trees

Moderate - 20-60% tree mortality, a mosaic of live and dead trees left

Low - < 20% tree mortality, mostly an underburn

We assumed that all stands that had mature trees and had burned in intense, high or moderate- high intensity were post-fire habitat and therefore, suitable black-backed woodpecker habitat. We assumed that Forest Service lands would need to provide the bulk of intact post-fire habitat because the private land and the tribal land within the fire perimeter would be salvage logged and no longer provide black-backed woodpecker habitat. We worked with Montana Dept. Natural Resources and Conservation personnel to identify areas they would salvage and identify leave patches on state land that would result in larger patches when combined with leave patches on FS land.

From the map of intense, high or moderate- high intensity fire, we omitted areas that had past regeneration timber harvest because there were no mature trees. Some of the remaining habitat had past partial timber harvest and field inventory indicated that these stands had enough residual trees to be still suitable for black-backed woodpeckers. We then assumed all habitat was of equal value for black-backed woodpeckers, because we had no criterion to help us make any other determination. The result was that the 400 acres of salvage of post-fire habitat was planned in areas that were the most economical from a timber sale standpoint. This was areas next to roads and areas with the highest volumes per acre. Figure 2 indicates where salvage was planned in post fire habitat.

There was one large block in upper Henry Creek that would be left intact because it was too far from roads.

POST PLANNING MONITORING

Since we were not satisfied with the information in the literature to help aid in design of salvage sales for black-backed woodpeckers, we monitored the Boyer fire in spring after the fire (1999) to determine if black-backed woodpeckers and other woodpecker species were selectively using post fire habitat in Boyer. In other words, were woodpeckers nesting in certain portions of the fire and not others? Were the areas we left unsalvaged specifically for black-backed woodpeckers used by the species or other species? The salvage sale was planned to be sold in summer 1999, however appeals postponed this and the sale was not sold until fall 2000. Therefore, we were able to collect information for two years post fire.

METHODS

Available time and dollars were a factor in the monitoring design. We were primarily interested in black-backed and three-toed woodpeckers (but also other woodpecker and songbird species). Working with researchers from the Forestry Sciences Lab, we determined that the best information we could gather with the least cost was to do time constrained nest searches in equal sized areas of post-fire habitat. The time constraint was to help insure equal sample intensity. We did not have money to inventory the entire burn and since the available literature strongly suggests that black-backed woodpeckers nest in stand replacement fire rather than low intensity burns, we limited our nest searches to the higher burn intensities. Fifteen survey patches were used, 7 small (each approximately 40 acres) and 8 large (each approximately 150 acres) (Figure 3). The patches were in primarily intense, high and moderately high burn intensities and encompassed the vast majority of these burn intensities on FS lands. There also was some moderate intensity within these patches that was surveyed. The monitoring was limited to FS lands.

Protocol for nest searches in 1999 is as follows. Trained searchers walked through the area for a given amount of time, searching for woodpeckers both visually and aurally. When an individual was located (no matter what species), the bird was followed until it either flew out of the search area, flew out of sight or a nest was found. Woodpeckers are active all day and therefore do not need to be inventoried early in the morning. However, searches consistently began between 0800 and 0900. Searches were not done if weather was not conducive to inventory (too windy or rainy). Searches began May 4 and continued through June 30. A total of 20 person-days were spent on nest searches.

Point counts were also conducted in each patch to determine what other songbird species were present. Point counts followed standardized protocol (Ralph et al. 1993). Three or four point counts were conducted in each patch, depending on patch size. A total of 10 person-days were spent on point counts.

In 2000, very little money was available for monitoring. Therefore, nest searches were in the same areas with the same time constraints but we focused on searching for black-backed woodpecker nests. We did not follow other species and only recorded nests of other species when they were obvious. In 2000, a total of 11 person-days were spent on nest searches.

RESULTS AND DISCUSSION

Woodpecker Data

A total of 1480 acres were inventoried, which encompassed >95% of the intense, high and moderate-high intensity fire on Forest Service lands in Boyer that were considered black-backed woodpecker habitat. 20% of the moderate intensity fire areas were also surveyed in conjunction to this. In 1999, a total of 29 nests were found. In four of these locations, the actual nest hole was not visually located, however the behavior of the pair and/or the presence of recently fledged young indicated that the nest site was very close. Table 1 summarizes information about nests found in 1999.

Table 1. Characteristics of nest trees used by four woodpecker species in Boyer Fire in 1999

Species	**Nest Tree Species (% of nest locations in each tree species)**	**Mean Nest Tree DBH (inches)**	**Mean Nest Tree Height (feet)**	**Mean Nest Height (feet)**	**Burn Intensity**
Black-backed woodpecker (n=4)	75% western larch 25% Douglas-fir	10.3"	61.0'	19.7'	100% intense
Three-toed woodpecker (n=10)	50% western larch 50% Douglas-fir	8.5"	26.2'	11.1'	90% intense 10% high
Hairy woodpecker (n=7)	57% western larch 29% Douglas-fir 14% lodgepole pine	11.9"	59.9'	29.8'	86% intense 14% high
Northern Flicker (n=4)	50% western larch 50% Douglas-fir	18.5"	65.7'	32.5'	75% intense 25% high

In 2000, a total of 12 nests were found. Table 2 summarizes information about nests found in 2000. In three of these locations, the actual nest hole was not visually located, however the behavior of the pair and/or the presence of recently fledged young indicated that the nest site was very close.

Table 2. Characteristics of nest trees used by two woodpecker species in Boyer Fire in 2000.

Species	**Nest Tree Species**	**Mean Nest Tree DBH (inches)**	**Mean Nest Tree Height (feet)**	**Mean Nest Height (feet)**	**Burn Intensity**

Black-backed woodpecker (n=6)	50% western larch 33% Douglas-fir 17% ponderosa pine	11.5"	41.7'	16.7'	83% intense 17% high
Three-toed woodpecker (n=3)	33% western larch 33% Douglas-fir 33% lodgepole pine	10.0"	32.0'	17.0'	100% intense

Nest tree species was consistent with information found in other studies. All woodpeckers nested primarily in western larch and Douglas-fir. Although we do not have information to validate that woodpecker's nested in these species in greater proportion to what was available, two studies in this same drainage help support this. Within all study areas, including the Henry Peak fire (across the Henry Creek drainage from the Boyer fire), all cavity nesting species preferred Douglas-fir where Douglas-fir and lodgepole occurred in equal abundances in unlogged post-fire habitat and selected ponderosa pine and western larch in logged areas (where larch and ponderosa pine comprised only 12% of available trees; Hejl and McFadzan 2000). Also, a study within the Boyer fire measured use versus available tree species for foraging black-backed woodpeckers and determined that in the study area, tree species relative density was Douglas-fir - 63%, ponderosa pine - 17%, western larch - 8%, grand fir - 10% and other (subalpine fir and lodgepole pine) – 2%. Black-backed woodpeckers in this study preferred to forage on western larch and ponderosa pine in greater frequency than they were available as compared to Douglas-fir and grand fir (Powell 2000). Using these relative density figures for tree species in Boyer, it appears that woodpeckers were nesting in western larch in greater proportion that what was available. Nest tree dbh was consistent with other studies, with black-backed and three-toed woodpeckers nesting in smaller trees than hairy woodpeckers or northern flickers.

Figure 4 displays nest locations of black-backed woodpeckers found in the Boyer fire for both 1999 and 2000. Figure 5 displays nest locations for the three other woodpecker species (northern flicker, three-toed woodpecker and hairy woodpecker) found in the Boyer fire.

For black-backed woodpeckers, nest locations were fairly consistent between years. Nests were located in intense or high burn intensities and were not found above 5200' elevation. We found no nests in the moderately-high burn intensity (of which most was surveyed) and we found no nests in the moderate burn intensity (of which, 20% was surveyed). Nests were also clustered around the biggest contiguous patch of intense burn and were not found in the smaller, more isolated patches. Other woodpecker species were found throughout the fire, in small patches and above 5200', although most nest locations were also clustered around the biggest contiguous patch of intense burn.

In the 1800 acres of intense and high burn intensities surveyed, 6 black-backed nests were found in 1999, which is approximately 300 acres per pair. In 200, 9 nests were found, which is approximately 200 acres per pair.

We cannot determine the ultimate factor for nest selection. However, based on results

from other research, the results here are consistent with what is known about black-backed woodpeckers. All woodpecker species nested with the intense and high burn intensities, even though both moderately-high and moderate intensities were also surveyed. This supports that woodpeckers nest in areas of the highest burn intensities within fires in the Northern Rockies (Hejl and McFadzan 2000). Black-backed woodpeckers occur at lower elevations than three-toed woodpeckers (Marshall 1992). We found three-toed woodpeckers nesting in a wider variety of patches and at higher elevations than black-backed woodpeckers. Black-blacked woodpeckers, like most species, probably select nest sites as a function of food availability. Powell (2000) found that black-backed woodpeckers within his study areas (one being the Boyer fire) consistently foraged on trees with higher prey densities as compared to random trees. It is likely that black-backed woodpeckers (as well as other woodpeckers) select nest sites in places where they have abundant food. In the Boyer fire, the large patch of stand replacement fire in the center of the fire was likely the most valuable place for nests in year 1 and 2 after the fire, based on the location of nests compared to areas surveyed where no nests were found. It is likely that the value of this area for nesting will decline over time, as the abundance of wood-borers decreases. Other parts of the burn, especially areas of moderate and low intensity may become more valuable due to secondary mortality by bark beetles. However, for two reasons, these areas may not be as valuable for black-backed woodpeckers. First, there is strong evidence that black-backed woodpeckers key in on wood borers and trees killed by bark beetles have lower densities of wood borers than trees killed by fire (Powell 2000). Second, the number of trees that will die in a given patch will be less than what occurs in a stand replacement fire, because of the mix of tree species and differential susceptibility to insect mortality. Thus, these stands with secondary mortality will probably not support the numbers of woodpeckers as was supported by the large patch of post-fire habitat in the Boyer fire.

We also mapped the locations of black-backed woodpecker nests with the areas proposed for salvage, to determine how well our leave areas corresponded with nest locations for black-backed woodpeckers (Figure 6). Considering nests from both 1999 and 2000, 33% of black-backed woodpecker nests were within salvage units, 20% were on the edge of salvage units and 47% were > 350' from salvage units. Considering nests of all species, 32% of nests were within salvage units, 17% were on the edge of salvage units and 51% were > 350' from salvage units. There was a total of 3920 acres of post-fire habitat, 400 acres, or 10%, of which was in salvage units. It appears that this 10% of the post-fire habitat was very valuable for nesting woodpeckers, considering the proportion of nests within or adjacent to salvage units (53% of black-backed woodpecker nests and 49% of all woodpecker nests). The effects of this are probably even greater because birds from nests farther away are likely using the units to forage and loss of this habitat would adversely affect them as well.

It appears that our assumption that all of the habitat in intense, high and moderately high burn intensities was equal for black-backed woodpeckers was not valid, at least for the first two years after the Boyer fire. Possible reasons for this include differences in tree species. Western larch, Douglas-fir and ponderosa pine are more valuable in Boyer for black-backed woodpeckers than lodgepole pine, subalpine fir or grand fir. Also, average

tree size and density was probably greater in the areas salvaged than other areas because salvage was focused on area with greater economic benefits and thus greater volumes per acre. Since wood-borer density is positively correlated with increased tree diameter, it makes sense that the highest volume stands provide the most food for woodpeckers (Powell 2000). Unfortunately, this data was not available for the entire burn when we planned the sale. Also, because black-backed woodpeckers nest in small diameter trees, we assumed that stands with small average diameters would be as valuable as stands with larger average diameters. Based on Powell's (2000) foraging ecology data and our nest site data, this was not the case within the Boyer fire.

Point Count Data

Thirty-two different species of bird were detected during point counts in intense, high and moderately high burn intensities in the Boyer fire in 1999 (Appendix A). Six of these were detected flying over or outside of the patch with the point count. Studies have demonstrated that many bird species, not just woodpeckers, use post-fire habitat (Hutto 1995, Caton 1996, Hejl and McFadzan 2000). Therefore, it was not surprising to detect this many bird species. However, there is little data to suggest which patches within burned forests are most valuable to other bird species. Therefore, we separated the data into four patch types - small (40 acres) of mixed burn intensities, small (40 acres) of entirely stand-replacement fire, large (150 acres) of mixed burn intensities, large (150 acres) of entirely stand-replacement fire. More species were detected in the large, stand-replacement patch than other patches (Appendix A). Also, a higher proportion of many species were detected in this patch type as compared to other patches. Nine species had distributions across patches that were significantly different than expected if they occurred in these patches uniformly (chi square test, $p < 0.05$). These 9 species were Hammond's flycatcher, black-capped chickadee, American robin, mountain bluebird, Cassin's vireo, Audubon's warbler, western tanager, dark-eyed junco and Cassin's finch. The rest of the species had small sample sizes or had distributions that were no different than you would expect if they used all patches equally. These results are based on one point count and are of detections only and do not indicate that these species were successfully nesting in these patches. However, it is likely that they were using them for either nesting or foraging and therefore, found some value in the patch.

These results support the value of the large patches of post-fire habitat for species other than black-backed woodpeckers. They also support the value of other burn intensities for different bird species. It is likely than some of these species were nesting in remnant patches of live trees and then foraging in the stand-replacement burns.

CONCLUSIONS

Managing for black-backed woodpecker as well as other bird species involves retention of intact stands of post-fire habitat.

The first year of post fire monitoring indicated that black-backed woodpeckers did not nest in small patches with the Boyer fire. The second year of monitoring located some

nests in small patches. However, the majority of black-backed woodpecker (60%) as well as other woodpecker species nests (59%) were clustered around the largest patch of contiguous intense burn in the center of the Boyer fire. Other species did nest in small patches.

Patch size and burn intensity alone are probably not driving nest selection. Tree size and species are probably also important.

Insect density, particularly wood-borer density, probably drives black-backed woodpecker nest site selection. Based on information from many studies as well as our monitoring in Boyer, black-backed woodpeckers prefer western larch, Douglas-fir and ponderosa pine for both nest tree selection and foraging tree selection.

Although nest tree dbh for black-backed woodpeckers and three-toed woodpeckers is relatively small, trees they forage on are larger. Mean tree dbh that black-backed woodpeckers were observed foraging on in Boyer was 12.2" (as compared to mean available tree dbh in this study area of 8.2") and 17.5" in Warrior Face study area (as compared to mean available tree dbh in this study area of 8.6") (Powell 2000). Therefore, the pattern of nest locations observed in Boyer post fire is likely a function of tree size and burn intensity, with most nests clustered around the largest patch of intense burn with the greatest mean tree diameters.

Other bird species also use post-fire habitat and different species use different burn intensities.

MANAGEMENT RECOMMENDATIONS

Using information from literature available on black-backed woodpeckers as well as information from monitoring on the Boyer fire, we developed the following recommendations for future post fire habitat management, including burn area assessments for the fires of 2000.

1. Conduct a Forest scale assessment of historic versus current amounts of source habitats for black-backed woodpeckers, including trends of subalpine, montane and lower montane old forests, managed and unmanaged young forest stages of lodgepole pine, areas of large scale insect infestations and burned forests. The assessment of burned forests should include estimates of amounts of post-fire habitat that currently exist compared to estimates of amounts that occurred historically and should consider historic fire regimes.

2. Post-fire habitat should be considered to have the greatest value as source habitat for black-backed woodpeckers as compared to other source habitats. This is based on information that black-backed woodpeckers have greater nest success, occur in greater densities and have smaller territories in post-fire habitat than other habitats. The evidence for this is limited, however all available research on black-backed woodpeckers in the Northern Rockies supports this. Until studies

are done to indicate that other source habitats have the same or greater value, measured by nest success or territory size, we must assume post-fire habitat is of greater value.

3. Given the sensitive status of black-backed woodpeckers, the downward trend in source habitats in the entire Interior Columbia River Basin and the lack of post-fire habitat due to fire exclusion, logging of post-fire habitat should only be considered if the amount of post-fire habitat at the Forest scale over the past 5-6 years is reasonably close to historic estimates of post-fire habitat. The difficult question will be what is reasonably close? In 1998 on the Lolo N.F., we concluded that salvage logging when we only had an estimated 3-13% of historic amounts was not supportable and would result in a determination of "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species." It is probable that with larger fires, as occurred in 2000, amounts of post-fire habitat may approach historic averages and thus salvage logging may be less detrimental than in the relatively smaller fires of 1998. We do not know this for certain. Consideration of the past several years (5-6) of post-fire habitat must be included in any analysis. Conserving as much source habitat as possible is prudent.

4. If logging is considered, measures taken at the Forest scale may help minimize impacts to black-backed woodpeckers as well as other woodpecker species. Measures include:

   A. Compensate for the loss of post-fire habitat by creating alternative habitat in other parts of the Forest. Consider creating post-fire habitat in ecosystem burning projects, especially in areas outside of the suitable timber base.

   B. Focus logging in areas that are less valuable to woodpeckers. Given the information available, it appears that stands containing western larch, Douglas-fir, and ponderosa pine are more valuable than stands of subalpine fir and lodgepole pine. Grand fir may also not be as valuable, however, the data on this are unclear (Powell 2000).

   C. Leave some large patches of intact post-fire habitat, including entire fires. The size to leave is relative to the size of the fire, however we suggest that leaving a few larger patches or one very large patch is probably more valuable than scattered small patches, especially if managing for black-backed woodpeckers is an objective. Wisdom et al. (2000) suggest leaving patches of at least 956 acres, based on home range sizes of black-backed woodpeckers in mature and old forests. Include some of the most valuable habitat for black-backed woodpeckers in these patches. This means leaving patches that have large trees and contain either ponderosa pine, Douglas-fir or western larch (or a mix of species that includes some of these). Leaving only patches in high elevations (> 5000') dominated by lodgepole pine and subalpine fir or is not adequate. Also consider stands that have burned so hot as to have

completely burned off bark to be unsuitable (or of low quality) for woodpeckers. Stands that have intense fire but still have intact (but charred) bark are most likely high quality black-backed woodpecker habitat. Even if branches and needles have been consumed, as long as there is enough bark to keep the phloem and xylem moist, wood-borers will be abundant (Powell 2000).

D. There is value to small patches as well. In previous monitoring on the Lolo N.F., we found woodpeckers, including black-backed woodpeckers, nesting in small (< 100 acre) fires. We have also found woodpeckers nesting in small patches of stand replacement fire that occurred during prescribed burning. In one example, a 20 acre stand contained a black-backed woodpecker nest, a hairy woodpecker nest and a northern flicker nest (O'Connor et al. 1997). Conserving intact small patches across a wide geographic area is important for all woodpecker species.

E. There is also value to woodpeckers and other bird species to patches of low and moderate intensity fire. Areas with these burn intensities should also be retained.

5. If logging is considered, measures taken at the smaller, fire scale may help minimize impacts to black-backed woodpeckers as well as other woodpecker species. Measures include:

A. Wisdom et al. (2000) suggest to avoid salvage of post-fire habitat until 5 years after the burn. This is not practical, as the value of the wood declines and is not marketable after 2-3 years. If possible, delay salvage until the second year post-fire.

B. Wisdom et al. (2000) suggest to retain snags in clumps and retain at least 42 snags per acre of dbh > 9". There is evidence from Saab and Dudley (1998) that black-backed woodpeckers nested in salvaged areas with retained snags of this size and density. This snag retention may be uneconomical. If less snags per acre or smaller sizes are left, assume the area will not support nesting black-backed woodpeckers after logging.

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Appendix A. Summary of point counts in Boyer fire

Patches were divided into four groups and results are displayed by groups. The small patches were approximately 40 acres each and the large patches were 150 acres each. The percent is the percent of that species found in the patch type based on density of birds observed. A blank indicates no birds of that species were detected in that patch type. The number in parentheses after the species indicates the total number of detections of that species during point counts.

Species	**Small patch – mix of burn intensities**	**Small patch – all intense, high or moderately-high**	**Large patch – mix of burn intensities**	**Large patch – all intense, high or moderately high**
Total Species	15 species	7 species	14 species	21 species
Cooper's Hawk (1)				100%
Hairy Woodpecker (6)		38%		62%
Three-toed Woodpecker (4)				100%
Black-backed Woodpecker (1)			100%	
Northern Flicker (5)		24%		77%
Unknown woodpecker (5)	25%			75%
Hammond's Flycatcher (7)		77%	11%	11%
Dusky Flycatcher (1)				100%
Mountain Chickadee (2)		57%		43%
Black-capped Chickadee (12)		39%	15%	46%
White-breasted Nuthatch (1)				100%
Red-breasted Nuthatch (2)		57%		43%
Ruby-crowned Kinglet (16)		7%	17%	76%
American Robin (34)		48%	8%	44%
Townsend's Solitare (10)			10%	90%
Mountain Bluebird (21)		49%		51%
Cassin's Vireo (13)	9%	28%	21%	42%
Audubon's Warbler (39)	12%	43%	4%	40%
Townsend's Warbler (16)		15%	23%	62%
Orange-crowned Warbler (1)	100%			
Brown-headed Cowbird (1)				100%
Western Tanager (13)		28%	35%	37%
Chipping Sparrow (16)		23%	12%	65%
Dark-eyed Junco (38)	6%	34%	2%	58%
Cassin's Finch (16)		74%	10%	15%
Pine Siskin (2)				100%

Species detected during point counts that were flying over or were detected outside of the patch being surveyed:

Spotted towhee (1)
Song sparrow (1)
Red-tailed hawk (1)
Common Raven (1)
Ruffed grouse (3)
Pileated woodpecker

Figure 1. Fires 1975-1998 on the Lolo N.F. compared to the historic average

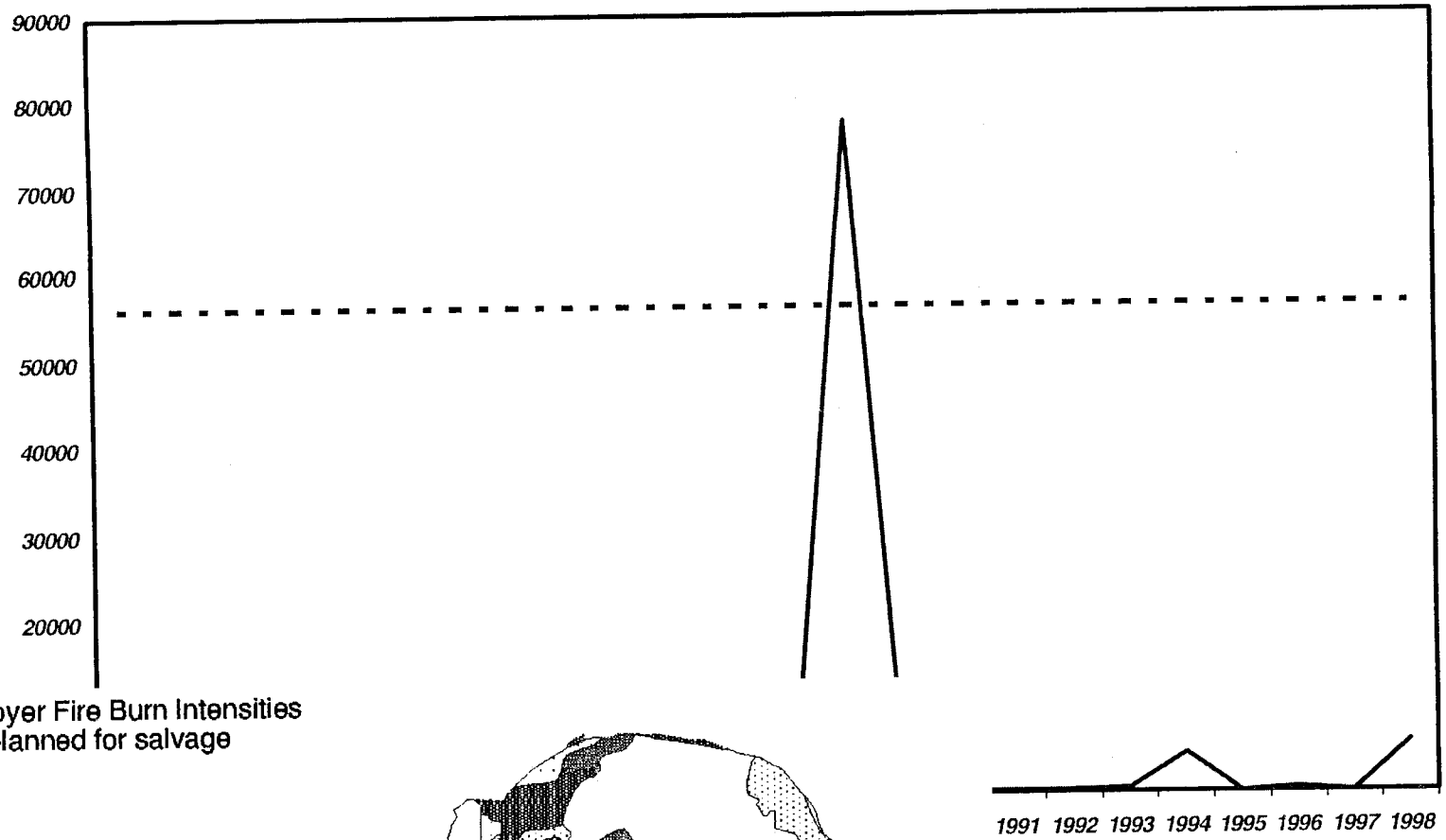
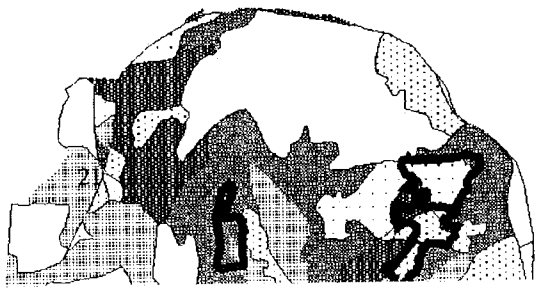
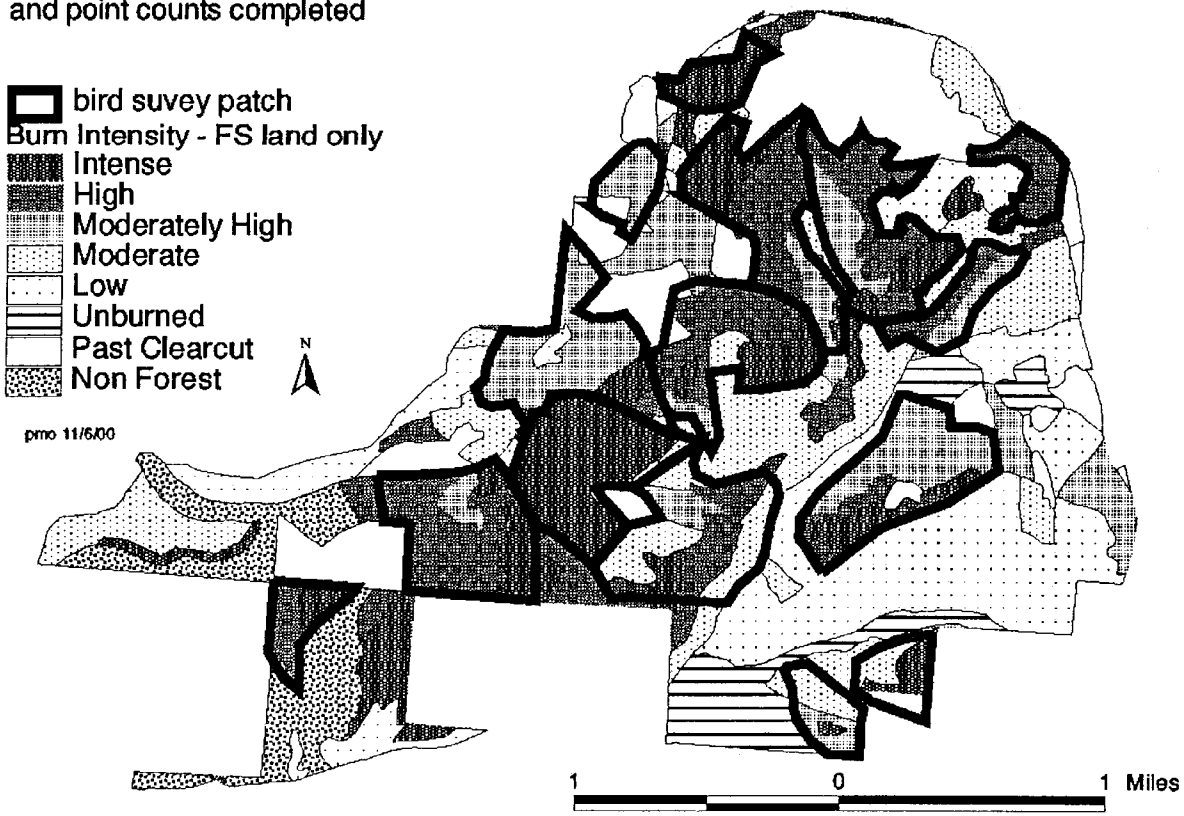


Figure 2. Boyer Fire Burn Intensities and areas planned for salvage



Proposed Salvage Havest
Burn Intensity - FS land only
Intense
High
Moderately High
Moderate

Figure 3. Boyer Fire Burn Intensities and areas surveyed for woodpeckers and point counts completed



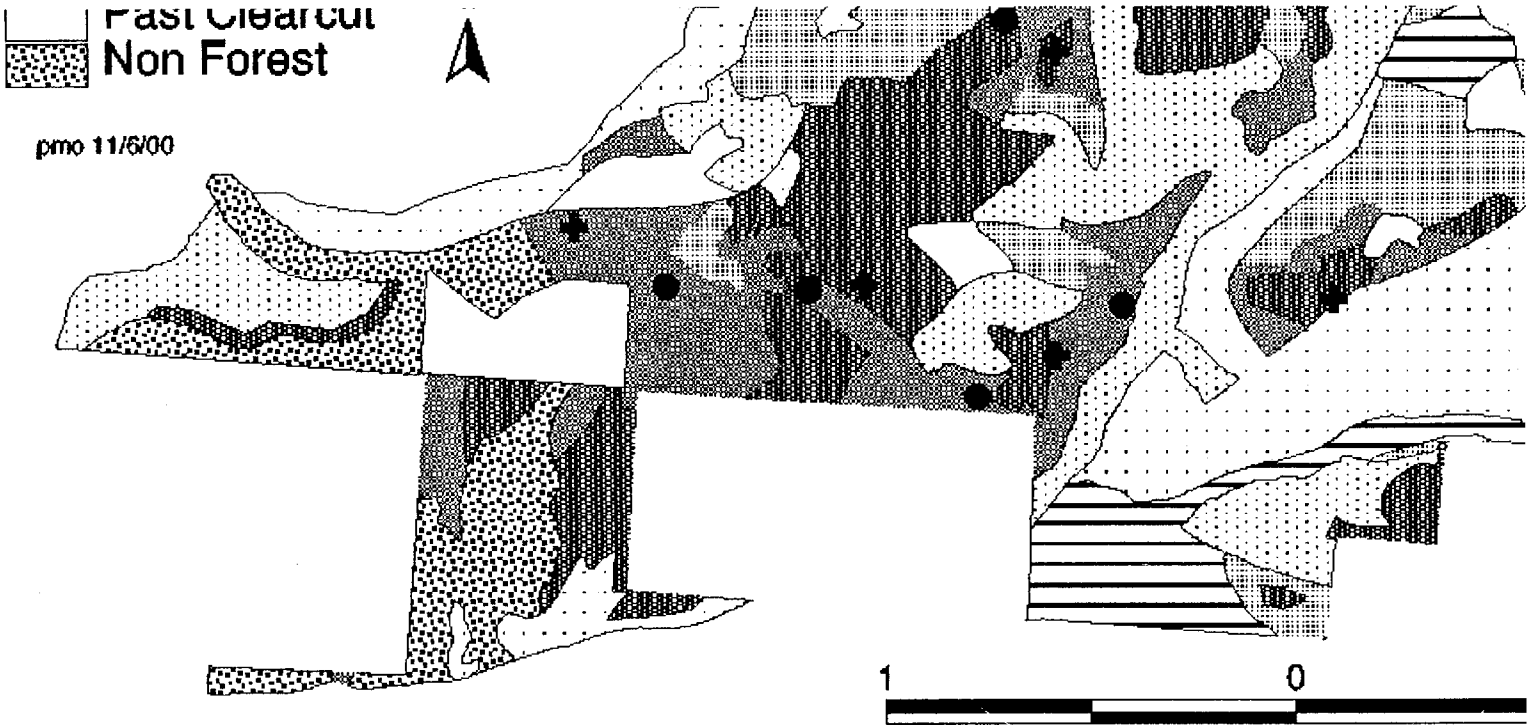

Past Clearcut
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Figure 5. Boyer Fire Burn Intensities and all woodpecker nest locations - 1999 and 2000

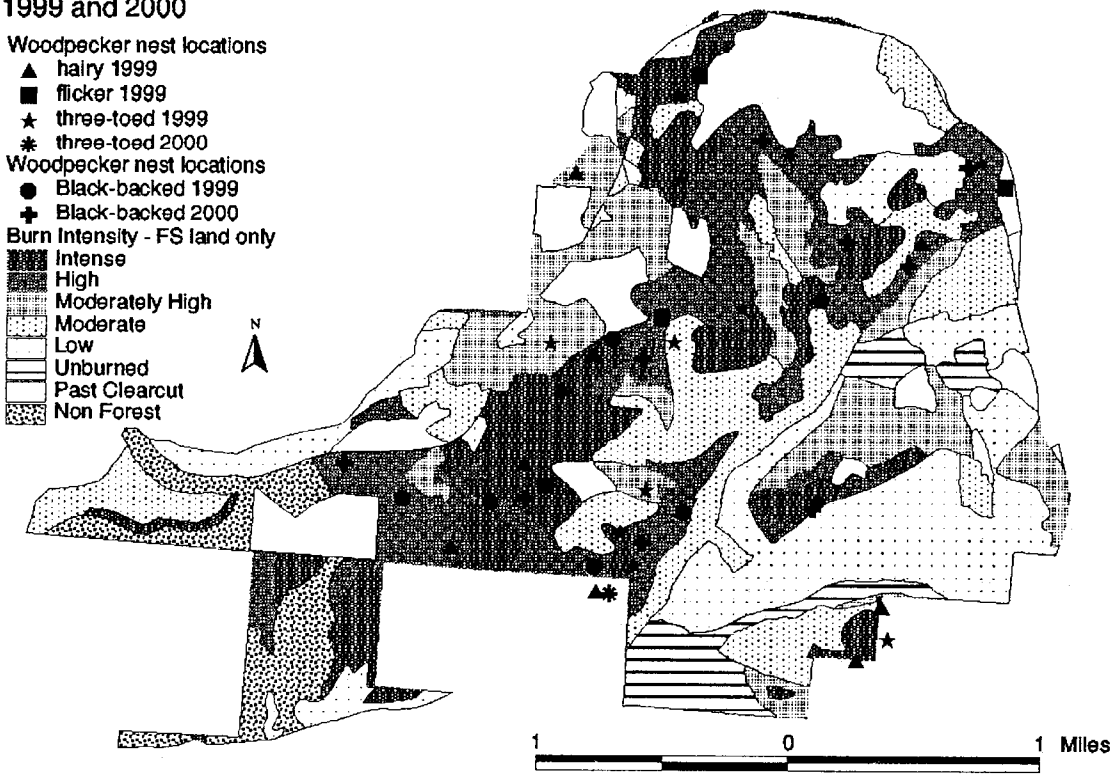
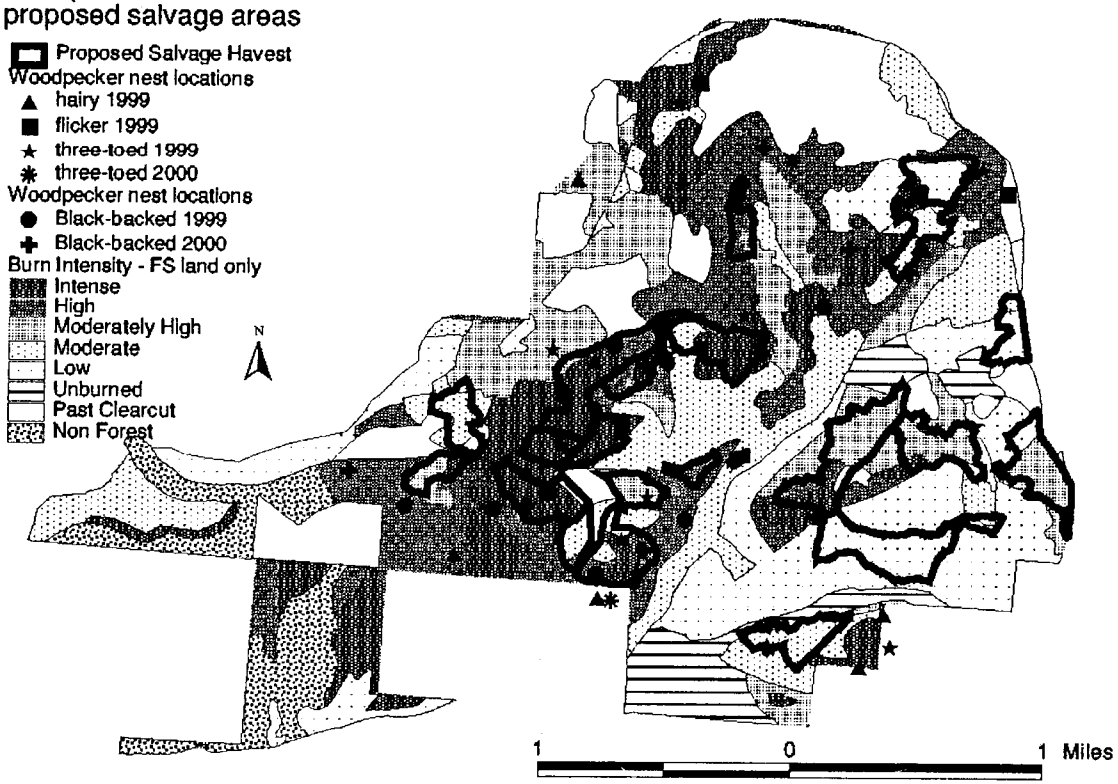


Figure 6. Boyer Fire Burn Intensities, woodpecker nest locations and proposed salvage areas



pmo 11/6/00